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(54) **SUCTION DEVICE FOR SPINNING MACHINES AND SPINNING MACHINE**

SAUGVORRICHTUNG FÜR SPINNMASCHINEN UND SPINNMASCHINE

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention concerns the field of spinning machines, for example the field of ring spinning machines, and concerns a spinning machine comprising an improved suction system, capable of drawing in broken yarn in an advantageous manner.

[0002] More particularly, the present invention concerns a suction system for spinning machines that is capable of varying its suction power according to the need, in such a way as to guarantee an effective suction action when required while at the same time reducing the drawbacks caused by suction when a suction action is not necessary.

DESCRIPTION OF THE STATE OF THE ART

[0003] Figure 1A schematically shows a side sectional view of a spinning machine 1000 according to the state of the art. In particular, the spinning machine 1000 comprises a supporting structure 1100 that provides a structural support to one or more of the components of the spinning machine 1000 that are described below. In other words, the supporting structure 1100 serves the function of a housing or frame for the spinning machine 1000. Furthermore, the spinning machine 1000 comprises at least two pairs of rollers 1201, 1202 and 1203, 1204, respectively. Figure 1A shows three pairs of rollers 1201 and 1202, 1203 and 1204, 1205 and 1206, as this at least one first roller is motor driven, while the second roller is driven and set moving by the first roller. For example, in the first pair of rollers 1201 and 1202, the first roller 1201 can be motor driven so that it moves in the direction indicated by the arrow located inside it, while the second roller 1202 is driven by the friction generated through contact with the first roller 1201. Even if this is not illustrated, the rollers 1201-1206, as well as the respective motors (not illustrated) and/or means for transmitting motion from the motors to the rollers (not illustrated), can be supported by the supporting structure 1100.

[0004] The pairs of rollers 1201 and 1202, 1203 and 1204, 1205 and 1206 constitute a spinning point 1200. The spinning point 1200 serves the function of spinning a first textile element 1301, thus obtaining a second textile element 1302. The first textile element 1301 can be, for example, a set of fibres called slubbing. The first textile element 1301 can originate from a first collection element 1303 that, for example, can be constituted by a reel on which it is wound.

[0005] In order to carry out the spinning operation, at least two of the pairs of rollers 1201 and 1202, 1203 and 1204, 1205 and 1206 rotate at different speeds. For example, the pair of rollers 1205 and 1206 can rotate at a higher speed than the pair of rollers 1203 and 1204.

[0006] Due to the difference in the rotation speeds of the pairs of rollers, the first textile element 1301 is

stretched and then, when leaving the rollers, it is twisted so that it winds on itself and becomes stronger and more resistant, and then it is wound on the second collection element 1304.

[0007] Following said spinning operations, the first textile element 1301 becomes a second textile element 1302 that is thinner and/or stronger than the first textile element 1301. The second textile element 1302 can be, for example, a thread or yarn. The second textile element 1302 can be collected by a second collection element 1304 that, for example, can be a coil or a spindle.

[0008] It can be noted that the spinning machine may contain, and generally contains, a plurality of spinning points 1200. Spinning machines with hundreds or more than a thousand spinning points are common. In these cases, each spinning point 1200 is associated with a first collection element 1303 and a second collection element 1304. For the sake of clarity, in the description of the present invention reference is made to only one spinning point 1200.

[0009] Due to the tension applied to the textile element 1301, 1302 during the spinning operation described above, the textile element 1301, 1302 may tear up, especially at the level of the pair of rollers 1205-1206. The portion of the textile element 1301, 1302 before the tear continues to be driven downwards by the rollers, with the risk of being wound around one or more of the rollers 1201-1206 and of damaging the rollers themselves and/or creating windings that need to be eliminated and make it necessary to restore the spinning point 1200 to the correct operating conditions, both of which are time-demanding operations. Furthermore, due to the tear, if the portion of textile element 1301, 1302 lowers down beyond the rollers, it can involve other spinning points 1200 that are close thereto and produce tears on the latter.

[0010] To prevent the above from occurring, a suction device is generally provided for each spinning point 1200, said suction device comprising a suction element 1402 connected to a suction opening 1401, located in proximity to the textile element 1301, 1302, through a suction pipe 1403. In particular, the suction element 1402 can be an extraction unit, a pump or any means capable of generating a negative pressure in the suction pipe 1403, which in turn creates an air flow towards the inside of the suction opening 1401. This air flow makes it possible to draw in the textile element 1301, 1302 before the tear, in such a way as to avoid the problems described above, as schematically shown in Figure 1B.

[0011] In particular, as can be observed in Figure 1B, while the portion of the second textile element 1302 after the tear is collected in the second collection element 1304, the portion of the first textile element 1301 and/or of the second textile element 1302 before the tear is drawn inside the suction opening 1401 and thus inside the suction pipe 1403. Collection means (not illustrated) ensure that the first textile element 1301 and/or the second textile element 1302 drawn inside the suction pipe

1403 is collected and does not interfere with the operation of the suction element 1402. In this way, the first textile element 1301 and/or the second textile element 1302 can be prevented from remaining rolled up on one or more of the rollers 1201-1206 due to the tear, or from producing other tears in the near spinning points 1200 while moving forward in an uncontrolled manner. This solution, however, poses a series of drawbacks.

[0012] In particular, in a spinning machine made up of hundreds or more than a thousand spinning points the overall suction effect produced by the sum of the individual suction actions performed for each one of the spindles requires a considerable quantity of energy. In particular, there may be an embodiment with a plurality of suction elements 1402, potentially one per each spinning point 1200, or a single suction element 1402 connected to a plurality of suction pipes 1403 and suction openings 1401. In both cases, the total power used by the suction system is considerable. By way of example, in a spinning machine comprising more than a thousand spinning points 1200 electric power in the order of 10 kW is required to ensure sufficient suction to each spinning point 1200.

[0013] Furthermore, the continuous operation of the suction system causes considerable noise during the use of the spinning machine 1000.

[0014] Due to leaks in the suction pipes 1403, suction may be different at the various suction openings 1401 and this does not guarantee that the textile elements 1301, 1302 are drawn in after being torn.

[0015] Inadequate suction may cause a blockage in the suction pipes 1403 and the suction openings 1401.

[0016] The patent EP 2233618 discloses a spinning machine comprising a suction system provided with a movable limiting device, usually placed in front of the suction opening. This makes it possible to partially reduce the suction power needed, as the limiting device reduces the flow of air drawn in and thus consumption by the suction system. Nevertheless, considerable suction power must in any case be guaranteed, because, as can be observed in Figure 2b, it is necessary to ensure that, in the presence of the limiting device, the residual suction action is sufficient to draw in a small thread. Furthermore, the residual suction action must also be sufficient to start drawing in a bigger thread, as can be seen in Figures 2c and 2d. In this case, an additional problem arises since, as can be seen in Figure 2d, the suction power must be sufficiently high, for the reasons described above, but not too high, in such a way as to avoid locking the limiting device in front of the suction opening at the moment when a larger thread must be drawn in, as shown in Figure 2d.

[0017] This problem, furthermore, becomes even worse if the spinning machine comprises a plurality of spinning points. In particular, as it is not possible to know how many spinning points will be torn at the same time, it is very difficult to calculate the actual average suction pressure that will be present at the level of the suction

opening, as this depends on how many suction openings are covered by the limiting device and how many are not, at a given instant. As it is impossible to determine the average value of the negative pressure at the level of the individual suction openings, it is very difficult to guarantee at every instant an average pressure value that falls within the useful interval described above.

[0018] Finally, in the case where the torn thread is too large to be drawn in using just the residual quantity of suction, the system disclosed by patent EP 2233618 does not allow the thread suction operation to be started, wherein said operation would in turn guarantee that the limiting device be opened and the large thread be completely drawn in.

[0019] Spinning machines comprising suction ducts according to the prior art are further known from documents CH 699 713 A2, GB 2 156 391, FR 2 794 137 A1 and DE 35 15677.

[0020] It is thus one of the objects of the present invention to provide a suction system that is better than those known in the state of the art. Special objects of the present invention aim to obtain a suction system with reduced power consumption and/or more silent operation and/or easier operation.

SUMMARY OF THE PRESENT INVENTION

[0021] The present invention is based on the general concept that the spinning machine 1000 does not need a constant suction action at the level of the opening 1401. On the contrary, it is sufficient to provide a suction action at the level of the opening 1401 at the moment when the first or the second textile element 1301, 1302 tears up. Since the tearing of the textile element 1301, 1302 is a relatively infrequent event, it is possible to avoid providing a constant suction action at the suction opening 1401 for most of the time, on condition that it is possible to guarantee a suction action at the level of the suction opening 1401 in the presence of a tear. The object of the invention is solved by a suction device according to claims 1 to 8 and a spinning machine according to claims 9 to 12.

BRIEF DESCRIPTION OF THE FIGURES

[0022] The present invention is illustrated here below through the description of the third, fourth, fifth, seventh, eighth, tenth and eleventh embodiments of the same that are represented in the attached drawings 4A-4D, 5A-5D, 6A-6D, 8A, 8B, 9A, 11A, 11B, 12A and 12B. It should however be noted that the present invention is not limited to the embodiments represented in the drawings but, on the contrary, all those variants, modifications or combinations of the claimed embodiments represented and described herein that are clear and obvious to the expert in the art fall within the scope of the present invention.

- Figure 1A schematically shows a side sectional view of a spinning machine and a corresponding suction

- device according to the state of the art;
- Figure 1B schematically shows the operation of the spinning machine and of the corresponding suction device shown in Figure 1A;
- Figure 2A schematically shows a side sectional view of a spinning machine and a corresponding suction device according to a first embodiment;
- Figures 2B and 2C schematically show an enlarged view and the operation of a part of the embodiment shown in Figure 2A;
- Figure 3A schematically shows a side sectional view of a spinning machine and a corresponding suction device according to a second embodiment;
- Figure 4A schematically shows a side sectional view of elements of a spinning machine and of a corresponding suction device according to a third embodiment;
- Figures 4B and 4C schematically show a front view and a top view, respectively, of the embodiment shown in Figure 4A;
- Figure 4D schematically shows the operation of the embodiment shown in Figure 4A;
- Figure 5A schematically shows a side sectional view of elements of a spinning machine and of a corresponding suction device according to a fourth embodiment;
- Figures 5B and 5C schematically show a front view and a top view, respectively, of the embodiment shown in Figure 5A;
- Figure 5D schematically shows a variant of the embodiment shown in Figure 5A;
- Figure 6A schematically shows a side sectional view of elements of a spinning machine and of a corresponding suction device according to a fifth embodiment;
- Figures 6B and 6C schematically show a front view and a top view, respectively, of the embodiment shown in Figure 6A;
- Figure 6D schematically shows the operation of the embodiment shown in Figure 6A;
- Figure 7A schematically shows a side sectional view of a spinning machine and of a corresponding suction device according to a sixth embodiment;
- Figures 7B and 7C schematically show an enlarged view and the operation of a part of the embodiment shown in Figure 7A;
- Figures 8A and 8B schematically show a side sectional view of parts of a spinning machine and of a corresponding suction device according to a seventh embodiment;
- Figure 9A schematically shows a side sectional view of a spinning machine and of a corresponding suction device according to an eighth embodiment;
- Figure 10A schematically shows a side sectional view of a spinning machine and of a corresponding suction device according to a ninth embodiment;
- Figures 10B and 10C schematically show an enlarged view and the operation of a part of the em-

bodiment shown in Figure 10A;

- Figures 11A and 11B schematically show two side sectional views of elements of a spinning machine and of a corresponding suction device according to a tenth embodiment;
- Figures 12A and 12B schematically show two side sectional views of elements of a spinning machine and of a corresponding suction device according to an eleventh embodiment;

DETAILED DESCRIPTION OF SOME EMBODIMENTS OF THE PRESENT INVENTION

[0023] Figure 2A schematically shows a side sectional view of a spinning machine 2000 and of a corresponding suction device according to a first embodiment which does not belong to the present invention.

[0024] In particular, the spinning machine 2000 differs from the known spinning machine 1000 thanks to the presence of a suction control element 2404. The suction control element 2404 can be made in any way suited to partially or completely reduce suction at the opening 1401 of the suction pipe 1403. In the embodiment shown in Figure 2A, the suction control element 2404 is preferably a butterfly valve, however the present invention is not limited to this solution, as can be seen here below.

[0025] In the case of execution of the suction control element 2404 through a butterfly valve, it is possible to modify the suction power at the opening 1401 by rotating the disc of the butterfly valve. Such a movement can be obtained through the actuator 2405, schematically illustrated and located at the centre of the butterfly valve's disc. This embodiment is particularly advantageous, as it makes it possible to precisely control the suction power at the opening 1401. In particular, as shown in Figure 2B, when the butterfly valve is completely open suction at the opening 1401 is maximized. On the contrary, as shown in Figure 2C, when the valve is completely closed suction at the opening 1401 is minimal, preferably null, except for a possible residual suction action due to the coupling tolerances between the disc and the seat of the valve. Controlling the actuator 2405 makes it possible to obtain any position between the two ends shown in Figures 2B and 2C.

[0026] Therefore, such an embodiment makes it possible to regulate the suction power at the opening 1401 in a controlled manner. In particular, if there are no tears in the first or in the second textile element 1301, 1302, the suction control element 2404 partially or completely limits the suction power at the opening 1401. In other words, the valve is partially or completely closed, as shown in Figure 2C. Thanks to the closed configuration, the power necessary to maintain a negative pressure inside the suction pipe is reduced. In other words, the power consumed by the suction element 1402 is reduced thanks to the presence of the suction control element 2404.

[0027] When a tear is produced, the suction control

element 2404 is activated in such a way as to increase the suction action at the opening 1401, preferably to the maximum level. In other words, the suction control element 2404 is partially or completely opened, as shown in Figure 2B.

[0028] In this way, it is possible to obtain a spinning machine 2000 for spinning a textile element 1301, 1302 comprising: a spinning point 1200 for spinning the textile element; a suction device 1401, 1402, 1403 comprising the suction element 1402, the suction opening 1401 in proximity to the textile element 1301, 1302, and the suction pipe 1403 suited to connect the suction element 1402 to the suction opening 1401; a suction control element 2404 suited to be set at least in an open configuration and in a closed configuration, wherein in the open configuration the suction control element 2404 allows the suction element 1402 to draw through the suction opening 1401 and in the closed configuration the suction control element 2404 prevents the suction element 1402 from drawing in through the suction opening 1401; and an actuator 2405 suited to operate the suction control element 2404, configured in such a way as to set the suction control element in the open configuration in the presence of at least one tear in the textile element and to set the suction control element 2404 in the closed configuration when there are no tears in the textile element.

[0029] In the present description, open configuration can mean both a completely open configuration, as shown in Figure 2B, and a partially open configuration. Analogously, closed configuration can mean both a completely closed configuration, as shown in Figure 2C, and a partially closed configuration. Furthermore, it is possible for the closed configuration not to be completely closed, due to tolerances generated during the production of the suction control element 2404, which in any case allow a minimum quantity of air to flow in even in the configuration defined as completely closed.

[0030] The various ways in which the present invention makes it possible to ascertain the presence or the absence of a tear in the textile element 1301, 1302 are described here below. In general, the present invention can be implemented through any method that makes it possible to ascertain the presence of a tear and to consequently regulate the actuator 2405 of the suction control element 2404 in such a way as to reduce suction, preferably to zero, at the opening 1401 when no tears are present, and to increase, preferably to the maximum possible value, the suction power at the opening 1401 in the presence of a tear.

[0031] Even if in the embodiment illustrated herein the opening 1401 is located downstream of the last pair of rollers 1205, 1206, the present invention is not limited to this configuration. In alternative embodiments, the opening 1401 may be located in a lower or higher position. In particular, the opening 1401 may be located at the level of the last pair of rollers 1205, 1206, or between the pair of rollers 1205, 1206 and the pair of rollers 1203, 1204, as schematically shown in Figure 9A. More generally,

the opening 1401 may be located in any position that allows the textile element with the tear to be drawn, so as to prevent the textile element 1301, 1302 from being wound on one or more rollers 1201-1206.

[0032] In the embodiment illustrated, the opening 1401 is located downstream of the last pair of rollers 1205, 1206 in such a way as to draw in the textile element with the tear and prevent the textile element 1301, 1302 from being wound on one or more rollers 1201-1206.

[0033] In the embodiment illustrated, the suction control element 2404 is located on the suction pipe 1403, in proximity to the opening 1401. This configuration offers the advantage that at the moment when the suction control element 2404 is operated in order to increase the suction power at the opening 1401, the power increase takes place very quickly, preferably immediately, as the portion of the suction pipe 1403 between the suction control element 2404 and the opening 1401 is limited. However, the present invention is not limited to this case and the suction control element 2404 may be positioned on any point of the suction pipe 1403.

[0034] In general, independently of the position of the suction control element, this embodiment makes it possible to obtain a spinning machine 2000, in which in the closed configuration the suction control element 2404 partially or completely prevents the suction element 1402 from drawing through the suction opening 1401.

[0035] In the embodiment illustrated, the suction control element 2404 is obtained through a butterfly valve and a rotary actuator 2405. Nevertheless, the present invention is not limited to this configuration and other types of valve, for example a ball valve, or a gate valve, or other known types of valve, can be used. Considering that the breakage of the textile element is not a frequent event, the present embodiment makes it possible to maintain, at a given instant, most of the suction closing elements 2404 provided on the various spindles of the spinning machine 2000 in a partially or completely closed configuration, in such a way as to partially or completely reduce the suction action at the openings 1401 corresponding to the various spinning points 1200. In this way, the openings 1401 corresponding to the spinning points 1200 where a tear has been produced will benefit from a suitable suction action so as to recover the broken part of the textile element, thanks to the proper operation of the suction control element 2404. In other words, in a spinning machine 2000 having, for example, hundreds of spinning points 1200, at a given instant only part of the spinning points 1200 will have a tear and will consequently be provided with suitable suction power for drawing the torn textile element, if necessary with the maximum suction power. This makes it possible to limit the power consumption of the suction element 1402.

[0036] In particular, if a suction element 1402 is installed on each one of the spinning points 1200, the suction elements 1402 of the spinning points where there are no tears will consume less power, thanks to the fact that the suction control element 2404 is partially or com-

pletely closed. In a similar manner, in the case where a single suction element 1402 is provided for all of the spinning points 1200, for example through a connection to a plurality of suction pipes 1403, the single suction element 1402 will consume less power as, at least in part of the spinning points 1200, the suction control element 2404 limits the suction action in the respective spinning point, and consequently limits the respective power consumption. Furthermore, in some embodiments, in the case where a single suction element 1402 is used for the plurality of spinning points, considering that statistically only part of the spinning points 1200 will have a tear, the single suction element 1402 can be sized in such a way as to provide enough suction power to produce a suction action on a smaller number of spinning points compared to the total number of spinning points installed on the spinning machine, thus reducing the energy costs, the overall dimensions and the noisiness of the suction element 1402. For example, if statistically only 5% of the spinning points has a tear at every instant, the single suction element 1402 can be sized in such a way as to provide enough suction power for 5%-10% of the total spinning points.

[0037] In some embodiments it is not necessary to guarantee a precise suction pressure, as the operation of the suction control element 2404 can be compatible with a wide range of suction pressure values. This is due to the fact that the suction pressure is not included in the parameters that affect the operation of the actuator 2405 and of the suction control element 2404. In other words, the operation of the suction control element 2404 is controlled based on the presence or absence of a tear, independently of the value of the suction pressure inside the respective suction pipe 1403.

[0038] Figure 3A schematically shows a side sectional view of a spinning machine 3000 and of a corresponding suction device according to a second embodiment which does not belong to the present invention.

[0039] The spinning machine 3000 differs from the spinning machine 2000 in that the suction control element 2404 is replaced by a suction control element 3404. In particular, the suction control element 3404, preferably a potentiometer, is configured in such a way as to control, preferably electrically, the suction power of the suction element 1402.

[0040] This solution, for example, can be advantageously adopted in the case where each spinning point 1200 has its own independent suction element 1402 connected to a single suction pipe 1403. In this case, it is possible to partially or completely reduce the activity of the suction element 1402 when no tears are detected in the textile element. On the other hand, in the case where a tear is detected in the textile element, it is possible to partially increase the suction power or even to increase it up to the maximum value allowed by the suction element 1402.

[0041] Even though the suction control element 3404 has been described as a potentiometer connected to the

power supply of the suction element 1402, the present invention is not limited to this embodiment. Alternatively, other methods for controlling the power of the suction element 1402 can be implemented, such as, for example, voltage control, or control through a PWM controller, or similar electronic controls suited to control the power supplied to the suction element 1402.

[0042] In some embodiments, in the case of a spinning machine with many spinning points 1200 and a predefined number of suction elements 1402, potentially even one only, a suction control element 3404 may be associated with each suction element 1402 present in the spinning machine and it may be operated by a sum or combination of the values obtained from the actuators corresponding to each individual spinning point 1200.

[0043] Figure 4A schematically shows a side sectional view of elements of a spinning machine 4000 and of a corresponding suction device according to a third embodiment which belongs to the present invention. Figures 4B and C schematically show a front view and a top view, respectively, of the embodiment illustrated in Figure 4A. Figure 4D schematically shows the operation of the embodiment illustrated in Figure 4A.

[0044] In particular, the spinning machine 4000 is based on the spinning machine 2000 and differs from the latter exactly in the execution of the actuator 2405, which is shown only schematically in the spinning machine 2000 and is the actuator 4405 in the spinning machine 4000.

[0045] The actuator 4405 is a mechanical actuator, mechanically connected to the suction control element 2404. Consequently, a movement of the actuator 4405 will cause a movement of the suction control element 2404.

[0046] In particular, as shown in Figure 4A, the actuator 4405 comprises four elements 4405A, 4405B, 4405C and 4405D. The element 4405A is a rotation axis for the actuator 4405 and for the suction control element 2404. The rotation axis 4405A penetrates inside the suction pipe 1403 in such a way as to allow the suction control element 2404 and the actuator 4405 to be integrally connected to each other.

[0047] The elements 4405B and 4405C are extension arms that allow the rotation axis 4405A to be connected to the element 4405D. The shape of the extension arms is not limited to that illustrated in the figure, but alternatively other shapes allowing the operation of the actuator 4405 can be implemented, as described below. For example, instead of two extension arms 4405B and 4405C, a single, curved or linear extension arm may be provided between the elements 4405A and 4405D. The element 4405D is a feeler. When the textile element 1301, 1302 is continuous, meaning with no tears, as shown in Figures 4A, 4B and 4C, the feeler 4405D is maintained in the position illustrated in the three figures by the second textile element 1302. In particular, due to the weight of the actuator 4405 and/or to the weight of the suction control element 2404, which may be made in an asymmetrical

manner, for example with different shape and/or weight of the parts of the rotary blade, so as to produce a resulting clockwise rotation force of the actuator 4405, the feeler 4405D tends to move downwards, following an angular movement caused by the rotation axis 4405A. However,

[0048] In this position, the feeler 4405D thus maintains the actuator 4405 in the illustrated position, which results in the closure of the suction control element 2404, as shown in Figure 4A. Even if it is represented in a completely closed configuration, the suction control element may be maintained in a partially closed configuration. As long as the textile element 1301, 1302 is continuous, the power required to create a negative pressure inside the suction pipe 1403 is thus limited, preferably considerably reduced thanks to the partial or, as shown, complete limitation of the suction action obtained by means of the suction control element 2404.

[0049] In the moment when the textile element 1301, 1302 tears up, as shown in Figure 4D, the feeler 4405D is no longer maintained in position by the textile element, as shown in Figure 4A. Being moved downwards by the weight of the feeler 4405D and/or by the weight of the actuator 4405, and/or by the weight of the suction control element 2404, possibly asymmetrical, the actuator 4405 performs a clockwise rotation that results in the partial or complete opening of the suction control element 2404, as shown in Figure 4D. In this open configuration, the suction control element 2404 allows the connection between the inside of the suction pipe 1403 and the opening 1401. Thanks to the movement of the suction control element 2404, the torn textile element is drawn into the suction pipe 1403, as illustrated.

[0050] In the embodiment shown in Figures 4A-4D it is thus possible to provide an actuator 4405 whose operation is based on the contact between a feeler 4405D and the textile element 1301 or 1302. In the moment when that contact does not exist any more, the actuator 4405 moves causing the suction control element 2404 to move from a closed configuration, in which suction is partially or completely prevented, to an open configuration, in which suction is partially or completely allowed.

[0051] Thanks to the embodiment described, it is thus possible to obtain a spinning machine 4000 in which the feeler 4405D is maintained against the textile element 1301, 1302 by a force generated by the weight of the feeler 4405D and/or of the actuator 4405 and/or by the weight of the suction control element 2404. Although not illustrated herein, the suction control element 2404 may be made in an asymmetrical manner in order to cause a rotation moment of the actuator. For example, in the case of a butterfly valve like the one illustrated herein, the half of the valve in the upper position in Figure 4A could be constructed so that it is heavier than the half of the valve in the lower position in Figure 4A. This solution, furthermore, offers the advantage that the actuator does not

need to be constructed with such a weight as to be able, alone, to operate the valve or, more generally, the suction control element 2404. This allows the actuator, or at least the feeler, to be produced using a wide range of materials, thus making it possible to choose materials that are suited to be used, in particular in the case of the feeler 4405D, in continuous contact with the textile element, which therefore need to have special characteristics intended to prevent the feeler itself from wearing out or from damaging the textile element 1301, 1302.

[0052] Even if in the embodiment described herein the actuator 4405 has been described as having a specific shape, the present invention should not be considered as limited to the described shape. More generally, it is possible to use any shape of the actuator that, in combination with the shape of the suction control element 2404, generates an angular or linear moment: an angular moment in the case of a suction control element 2404 with angular movement, such as a butterfly valve, or a linear moment in the case of a suction control element 2404 with linear movement, such as a gate valve. It will be clear to the expert in the art that various embodiments allow such a moment to be generated, in such a way as to ensure that the actuator, in the absence of the support provided to the feeler 4405D by the textile element without tears, can move together with the suction control element 2404, as a consequence of which the suction control element is positioned in the open configuration illustrated in Figure 4D.

[0053] Even though the actuator 4405 of the embodiment illustrated has been described in combination with a suction control element 2404 corresponding to a butterfly valve, the present invention is not limited to this solution. As an alternative, the actuator 4405 can be combined with any form of suction control element 2404 described in the present invention.

[0054] Alternatively, the actuator 4405 can be combined with any form of the suction control element 3404 previously described. In this case the actuator can act on a mechanical portion of the suction control element 3404, for example a mechanical control suited to regulate a potentiometer or a PWM controller. Alternatively, the actuator 4405 can furthermore act on a potentiometer or any other element that makes it possible to convert a mechanical signal into an electronic signal, and the resulting electronic signal can be used to control the suction control element 3404.

[0055] Furthermore, the actuator 4405 is advantageous as it positions the feeler on the side of the textile element 1301, 1302 opposite the opening 1401. This position is advantageous, as the feeler 4405D cannot be accidentally pushed downwards by the movement of the textile element, causing the undesired opening of the suction control element 2404. In the opposite case, in which the feeler 4405D is on the side of the textile element corresponding to the side of the opening 1401, the movement of the textile element may cause the feeler to be pushed downwards, causing the undesired opening of

the suction control element 2404. The Figure 5A schematically shows a side sectional view of elements of a spinning machine 5000 and of a corresponding suction device according to a fourth embodiment which belongs to the present invention, analogously to that which is shown in Figure 4A. Figures 5B and 5C schematically show a front view and a top view, respectively, of the embodiment of Figure 5A, analogously to that which is shown in Figures 4B and 5B.

[0056] The spinning machine 5000 is based on the spinning machine 4000 and differs from the latter due to the presence of the actuator 5405 that replaces the actuator 4405. The actuator 5405 differs from the actuator 4405 in that the extension arms 4405B, 4405C are not present on both sides of the actuator 5405, differently from the actuator 4405. In particular, as can be seen in Figure 5B and 5C, the extension arms are present on one side only, on the left in Figure 5B and at the bottom in Figure 5C.

[0057] This ensures the easy insertion of the textile element 1301, 1302 behind the feeler 4405D. In particular, while with the actuator 4405 it is necessary to take care to position the textile element 1301, 1302 correctly with respect to the feeler 4405D before proceeding to reconnect the two edges of the textile element 1301, 1302, or before installing a new textile element in the spinning point 1200, in the present embodiment the shape of the actuator makes it possible to position the textile element with respect to the feeler 4405D at any moment.

[0058] The advantage offered by the actuator 4405 compared to the actuator 5404 lies in that, even in the presence of considerable movements of the textile element 1301, 1302, the textile element cannot move out of the area delimited by the elements 4405B, 4405C and 4405D. Nevertheless, in the actuator 4405 this possible drawback can be mitigated by designing the feeler 4405D in a suitable shape. For example, a particularly long feeler 4405D reduces the risk of the textile element moving from behind the feeler 4405D. Alternatively, as shown in Figure 5D, a feeler 5405D in the shape of a U open on the side of the element 4405C reduces in a similar manner the risk of the textile element moving from its seat with respect to the feeler 4405D illustrated in Figure 5C.

[0059] As in the case of the actuator 4405, the actuator 5405 can be used both with the suction control element 2404 and with the suction control element 3404.

[0060] Figure 6A schematically shows a side sectional view of elements of a spinning machine 6000 and of a respective suction device according to a fifth embodiment which belongs to the present invention, analogously to that which is shown in Figure 4A. Figures 6B and 6C schematically show a front view and a top view, respectively, of the embodiment shown in Figure 6A, analogously to that which is shown in Figures 4B and 4C. Figure 6D schematically shows the operation of the embodiment of Figure 6A, analogously to that which is shown in Figure 4D.

[0061] The spinning machine 6000 is based on the spinning machine 4000, from which it differs as the actuator 4405 is replaced by the actuator 6405. In particular, the actuator 6405 corresponds to the actuator 4405, to which at least one adjustable stop element 6501 and 6502 is added. The stop element 6502 prevents the actuator 6405 from moving further in the anticlockwise direction with respect to the stop position illustrated in Figure 6A, while the stop element 6501 prevents the actuator 6405 from moving further in the clockwise direction with respect to the stop position illustrated in Figure 6D. It will be clear to the expert in the art that the two stop elements 6501 and 6502 illustrated depend on the specific shape of the actuator, and that different stop elements are possible in the case of a different embodiment, for example, of the extension arms 4405B and 4405C.

[0062] Thanks to the adjustable stop elements 6501, 6502, it is possible to limit the movement of the actuator 6405 within a predetermined area. In the case of an angular actuator like the one illustrated, within a predetermined angular area. This is an advantage, as it prevents undesired movements of the actuator which instead may result in unexpected movements of the spinning machine. For example, the textile element 1301, 1302 drawn in in Figure 4D may get stuck in the suction control element 2404 and cause the same to rotate on itself, in the clockwise direction, moving it back to the closed configuration and reducing the suction effect. Thanks to the presence of the stop elements 6501, 6502 such a risk of malfunction is avoided.

[0063] It is clear that it is possible to implement the invention even with just one stop element, obtaining the corresponding advantages associated with the single stop element.

[0064] Furthermore, the position of at least one of the stop elements 6501, 6502 is adjustable, for example through an adjusting screw or other adjusting systems. Thanks to this adjustment, it is possible to control the maximum degree to which the suction control element 2404 can be opened and closed. For example, if the stop element 6502 is located more leftwards with respect to the position illustrated in Figure 6A, if there are no tears it is possible to ensure that the suction control element 2404 remains only partially closed, and not completely closed as illustrated in the figure. Analogously, the complete or partial opening can be ensured by controlling the position of the stop element 6501.

[0065] Even though the actuator 6405 is based on the actuator 4405, the present embodiment is not limited to this case and the actuator 6405 could be based also on the actuator 5405, or on other actuators described in the present invention. Furthermore, as in the case of the actuator 4405, the actuator 6405 can be used both with the suction control element 2404 and with the suction control element 3404.

[0066] Figure 7A schematically shows a side sectional view of a spinning machine 7000 and of a respective suction device according to a sixth embodiment which

does not belong to the present invention. Figures 7B and 7C schematically show an enlarged view and the operation of part of the embodiment illustrated in Figure 7A.

[0067] The spinning machine 7000 is based on the spinning machine 2000 and differs from the spinning machines 4000-6000 in that the actuator 2405 is not constituted by the mechanical actuators 4405-6405, but by an electromechanical actuator 7405, preferably an electromagnet. In the figures, the electromechanical actuator 7405 is illustrated only schematically, as different specific embodiments are possible, such as, for example, an electromagnet, an AC motor, a DC motor, a stepping motor, a pneumatic or hydraulic motor, or other solutions that make it possible to mechanically activate the suction control element 2404 through the actuator 7405 based on an electric signal, possibly converted by a motor or compressor in the case of a pneumatic or hydraulic actuator. More generally, any element or system allowing the conversion from an electric signal to a mechanical movement can be used to obtain the electromechanical actuator 7405. The spinning machine 7000 comprises also a sensor 7601 suited to monitor the presence of the textile element. Even if in the figure the sensor 7601 is arranged in such a way as to monitor the presence of the second textile element 1302 in proximity to the second collection element 1304, the present invention is not limited to this configuration and the sensor 7601 can be placed in any position that allows the presence of the first or of the second textile element 1301, 1302 to be monitored.

[0068] The sensor can be, for example, an optical sensor that monitors the presence of the textile element in a predetermined spatial area, such as an optical transmitter-receiver pair or a movement sensor that monitors the movement of the textile element or controls the rotation speed of the cursor around the ring at the level of the second collection element 1304. More generally, any type of sensor that makes it possible to monitor the presence or absence of the textile element in a predetermined spatial area can be used to obtain the sensor 7601.

[0069] The sensor 7601 is also connected with the actuator 7405 of the suction control element 2404 through a connection (not illustrated herein). Thanks to such a connection, it is possible to control the actuator with the electric signal emitted by the sensor 7601. The connection can be wired or wireless.

[0070] In the case where the electric signal emitted by the sensor 7601 indicates the presence of the textile element, as shown in Figure 7C, the actuator 7405 will be controlled in such a way as to maintain the suction control element in the closed configuration. In the presence of a tear in the textile element, the situation is as illustrated in Figure 7B, where the textile element is not detected any more by the sensor 7601. In this case, the signal emitted by the sensor causes the actuator 7405 to move, so as to set the suction control element in the open configuration, as illustrated, and to cause the textile element with the tear to be drawn in.

[0071] This embodiment is particularly advantageous, as it makes it possible to avoid a mechanical contact with the textile element 1301, 1302, and is thus particularly suitable for the cases where the mechanical contact required by the mechanical actuators 4405, 5405, 6405 is not possible. Furthermore, thanks to the electrical connection between the sensor 7601 and the actuator 7405, it is possible to position these two elements with a high degree of flexibility.

[0072] Even though the embodiment illustrated above has been described with reference to a suction control element 2404, the present embodiment is not limited to this case, and the actuator 7405 can be used both with the suction control element 2404 and with the suction control element 3404. Even more advantageously, it is possible to connect the sensor 7601 directly to the suction control element 3404, in such a way as to allow a completely electronic control of the suction power, which does not require any mechanical movements.

[0073] Figures 8A and 8B schematically show a side sectional view of parts of a spinning machine 8000 and of a respective suction device according to a seventh embodiment which belongs to the present invention.

[0074] The spinning machine 8000 is based on the spinning machine 2000 and differs from the latter owing to the additional presence of a cutting element 8701 and a respective actuator 8702.

[0075] The cutting element 8701 shown herein is a generally circular element, with diameter substantially equal to that of the roller 1201, and placed in proximity to the latter. In this case, the actuator 8702 is an angular actuator, capable of making the cutting element 8701 rotate clockwise, until the end of the cutting element is introduced between the rollers 1201 and 1202 and remains squeezed between them, thus cutting the textile element 1301 and locking the portion of the textile element 1301 that is being introduced between the rollers 1201 and 1202.

[0076] It will be clear to the expert in the art that this is only a possible implementation of this embodiment and that alternative implementations may be used. For example, a cutting element having a linear shape and a linear actuator may be used to insert the cutting element between the two rollers 1201 and 1202. Alternatively, the cutting element may operate between the rollers 1203 and 1204, or between the rollers 1205 and 1206. Always alternatively, the cutting element may be a pair of scissors operated by a specific actuator, a blade, or any element controlled by a specific actuator and capable of cutting the textile element, preferably upstream of the rollers 1201-1206.

[0077] Thanks to this embodiment, it is possible to obtain the controlled cut of the textile element, which can be cut at any given instant. This is particularly advantageous if combined with any of the embodiments described herein.

[0078] In particular, in the embodiments described herein, when a tear is produced in the textile element

1301, 1302, the textile element with the tear is drawn into the suction pipe 1403. This considerably reduces the risk of this textile element getting twisted around one or more rollers 1201-1206, but can be unsatisfying in the case where the suction pipe 1403 keeps drawing in material, with problems in terms of blockage of the pipe and waste of material that thus cannot be spun.

[0079] By combining the action of the cutting element with the suction action described in relation to the above embodiments, it is possible to prevent the textile element 1301, 1302 from getting twisted around the rollers 1201-1206, and at the same time to limit the quantity of textile element drawn into the suction pipe 1403.

[0080] In order to have the two systems, meaning the suction system and the cutting system, operate in a substantially synchronous manner, it is particularly advantageous to make the cutting system operate in response to signals indicating the presence of a tear and described with reference to the other embodiments.

[0081] It will thus be possible to provide a spinning machine 8000 comprising a cutting element 8701 suited to cut the textile element 1301 and an actuator 8702 suited to operate the cutting element 8701, wherein the actuator 8702 suited to operate the cutting element 8701 is activated, preferably in a mechanical manner through a mechanical connection, by one of the mechanical actuators described above and suited to operate the suction control system 2404, 3404, or wherein the actuator 8702 comprises one of the mechanical actuators. Alternatively, the actuator 8702 for operating the cutting element 8701 and one of the mechanical actuators for operating the suction control element 2404, 3404 may be a single actuator. In other words, not only the suction control element 2404, 3404, but also the cutting element 8701 can be connected to one of the mechanical actuators 2405, 4405, 5405, 6405, 11405, 12405, in such a way as to activate the cutting element 8701 based on the movement transmitted by the mechanical actuator. This solution can be obtained, for example, by positioning in a coaxial manner the rotation axis of the cutting element 8701 and of the suction control element. Such a solution, for example, can be obtained by properly directing the suction device upwards.

[0082] In a similar manner, it is possible to combine the present embodiment with the spinning machine 7000, using an electromechanical actuator 8702, preferably an electromagnet, and controlling the actuator 8702 with the signal emitted by the sensor 7601, analogously to that which has been described with reference to the operation of the electromechanical actuator 7405. In addition to or as an alternative to the above, in some embodiments it is also possible to use the sensor 7601 only to control the actuator 8702 of the cutting element 8701, while the operation of the actuator of the suction control element is of the mechanical type. Alternatively, the actuator 8702 and the actuator 7405 may be constituted by a single electromechanical actuator, activating both the cutting element 8701 and the suction control element 2404,

3404. Such an embodiment, for example, can be obtained through a mechanical connection between the two actuators, thanks to which the movement of an actuator is reflected on the other actuator.

[0083] In the embodiments described above, in particular those embodiments in which there is the cutting element 8701 together with the respective actuator 8702, for example when using an electromechanical actuator 7405 to control the suction control element 2404, 3404, it is also possible to operate the electromechanical actuator 7405 only for a specific time interval, for example 15-60 seconds, in such a way that the suction control element 2404, 3404 remains in the open configuration only for the time necessary to draw in the portion of textile element cut by the cutting element 8701. Once said specific time interval has elapsed, the electromechanical actuator 7405 can operate the suction control element 2404, 3404 so that it returns to the closed configuration.

[0084] As an alternative to the predefined activation time, for example 15-60 seconds, it is possible to use a further sensor 10602 whose operation is similar to that of the sensor 7601, but which is positioned before the suction opening 1401, preferably between the spinning point 1200 and the suction opening, for example between the roller 1205 and the suction opening 1401, and which detects the presence of the cut portion of the textile element.

[0085] An embodiment which does not belong to the invention and including said second sensor is schematically illustrated in Figures 10A-10C, in which the spinning machine 10000 differs from the spinning machine 7000 due to the presence of a second sensor 10602. When the second sensor 10602 and the first sensor 7601 detect the presence of the textile element, the suction control element 2404, 3404 is maintained in the closed configuration, as shown in Figure 10A. When the first sensor 7601 and/or the second sensor 10602 do not detect the presence of the textile element, the suction control element 2404, 3404 is open, as shown in Figure 10B. Finally, when the second sensor 10602 does not detect the presence of the cut textile element any more, the electromechanical actuator 7405 activates the suction control element 2404, 3404 so that it returns to the substantially closed configuration. In other words, the actuator 2405, 4405, 5405, 6405 suited to operate the suction control element 2404, 3404 is configured in such a way as to set the suction control element in the closed configuration at least in response to the signal emitted by the second sensor 10602.

[0086] In this embodiment, suction is substantially activated only when there is a tear and for the time necessary to draw in the cut portion of the textile element 1301, 1302, therefore obtaining a further reduction in the consumption of the suction element 1402.

[0087] As indicated for the sensor 7601, it is also possible to additionally or alternatively use the sensor 10602 and/or the sensor 7601 in order to control only the operation of the actuator 2405, 4405, 5405, 6405, 7405 that

operates the suction control element 2404, 3404 and/or to control only the operation of the actuator 8702 that operates the cutting element 8701, and/or to control both of them.

[0088] The Figures 11A and 11B schematically show two side sectional views of elements of a spinning machine 11000 and of a corresponding suction device according to a tenth embodiment which belongs to the present invention.

[0089] In particular, the spinning machine 11000 is based on the spinning machine 2000 and differs from the latter with regard to the specific execution of the actuator 11405, only schematically shown in the spinning machine 2000, constituted by the actuator 11405 in the spinning machine 11000. Even more specifically, the operation of the spinning machine 11000 is similar to that of the spinning machine 4000 and the former differs from the latter only due to the shape of the actuator 11405 and of the suction control element 11404. In particular, the actuator 11405 comprises three elements 11405A, 11405B, and 11405D. In particular, the element 11405A is a rotation axis for the actuator 11405 and for the suction control element 11404. The rotation axis 11405A penetrates inside the suction pipe 1403 in such a way as to allow an integral connection between the suction control element 11404 and the actuator 11405.

[0090] The element 11405B is an extension arm that allows the rotation axis 11405A to be connected to the element 11405D. As in the case of the actuator 4405, the shape of the extension arm is not limited to the one illustrated.

[0091] The element 11405D is a feeler.

[0092] When the textile element is continuous, meaning that it has no tears, as shown in Figure 11A, the feeler 11405D is maintained in the represented position by the presence of the textile element. When a tear occurs, the feeler 11405D is not maintained in position any longer and the actuator 11405 rotates clockwise, causing the suction control element 11404 to open in a manner similar to that which has been described with reference to the spinning machine 4000.

[0093] The suction control element 11404 is similar to the suction control element 2404, as it operates in a manner similar to that of a butterfly valve, and differs from it due to the configuration of the two halves of the valve disc, which are not positioned at 180° with respect to each other, but with an angle smaller than 180°. Thanks to this solution, it is possible to guarantee a closed configuration, as shown in Figure 11A, obtaining, however, better suction in the case of an opening 1401 having a curved shape, like that illustrated in Figure 11B.

[0094] Even though the spinning machine 11000 has been described as based on the spinning machine 4000, the present embodiment is not limited to this solution and could be based, for example, on any other spinning machine described herein.

[0095] Figures 12A and 12B schematically show two side sectional views of elements of a spinning machine

12000 and of a corresponding suction device according to an eleventh embodiment which belongs to the present invention. In particular, the spinning machine 12000 is based on the spinning machine 11000 and differs from the latter for the specific configuration of the actuator 12405 that in the spinning machine 12000 comprises at least one adjustable stop element 12501, 12502 operating in a manner similar to that of the adjustable stop elements 6501, 6502.

[0096] The stop elements 12501, 12502 are mounted on an assembly or supporting element 12503, connected to the suction pipe 1403 and/or to the suction opening 1401 and/or to the structure that encloses the suction control element 11404, as illustrated.

[0097] In an embodiment, the stop elements 12501, 12502 can be screws or pins and the assembly element 12503 can be provided with a plurality of holes 12504, in such a way as to position and/or screw the stop elements 12501, 12502 in predetermined positions, and thus control the maximum opening and/or closing of the suction control element 11404. By way of example, Figure 12A shows an adjustment of the closing stop element 12502, which locks the suction control element 11404 in a configuration that is not completely closed, thus obtaining an opening 12902. This has the advantage of offering a minimum degree of suction, which makes it possible, for example, to maintain the suction pipe 1403 clean and/or to avoid damaging the suction element 1402, in the case where all of the spinning points 1200 are in the closed position.

[0098] In addition or as an alternative to the above, the assembly element 12503 can be connected to the rest of the suction element in a removable manner. For example, the assembly element 12503 can move according to the direction schematically indicated by the arrow 12505, and the movement can be stopped with a tightening screw not illustrated herein. This type of embodiment allows a precise and continuous adjustment of the predetermined region within which the actuator 12405 can move.

[0099] Furthermore, in some embodiments, the actuator 12405 may comprise an extension arm 12501 integrally connected to the actuator 12405, if necessary on the outside of the pipe 1403 on the side opposite the assembly element 12505, as well as a position sensor 12802. The extension arm 12501 can cooperate with the position sensor to determine the position of the actuator 12405. For example, the extension arm 12801 can be magnetic and the sensor 12802 can be a Hall sensor or a relay, preferably of the Reed type. Alternatively, the extension arm 12801 can be made in any material and the position sensor 12802 can be an optical sensor. Alternatively again, the extension arm 12801 can be avoided and replaced by the extension arm 11405B and/or, more generally, by any mobile element of the actuator 12405, if necessary by properly repositioning the position sensor 12802.

[0100] As can be seen in Figure 12A, in the closed

configuration the extension arm 12801 is misaligned with respect to the sensor 12802. As shown in Figure 12B, in the open configuration the extension arm 12801 is aligned with the sensor 12802, and the position sensor 12802 can thus emit a signal intended to indicate that the suction device is open. The signal can be used for various purposes, for example to activate a warning light 9902 and/or to activate the cutting actuator 8702 and/or to control the suction control element 3404.

[0101] Even though the assembly element 12503 and the adjustable stop elements have been described with reference to the present embodiment, it is clear that they can be implemented also in other embodiments described herein.

[0102] Analogously, even if the extension arm 21801 and the position sensor 12802 providing the electronic control have been described with reference to the present embodiment, it is clear that they can be implemented also in other embodiments described herein.

[0103] In all of the embodiments previously described, it is also possible to include a warning light, for example schematically represented by the warning light 9902 shown in Figure 9A, if mounted on the spinning machine, or in Figure 12A, if mounted on the suction device. The warning light 9902 is activated following the movement of the mechanical actuator 2405, 4405, 5405, 6405, 11405, 12405 or electromechanical actuator 7405 and/or in response to the signal emitted by the sensor 7601 and/or by the second sensor 10602 and/or by the position sensor 12802. More generally, the warning light 9902 is configured in such a way that it lights up when the suction control element 2404, 3404, 11404 is set in the substantially open configuration. In alternative embodiments, in which the suction control element 2404, 3404 is brought back to the substantially closed configuration after a predetermined time interval or in response to the signal emitted by the sensor 10620, the warning light 9902 can furthermore be configured so that it remains on in any case and needs to be switched off by the operator through a resetting operation. In this way, it is possible to warn the operator of the presence of the tear in the thread, so that the operator can provide for repairing the textile elements or for reconnecting the torn ends. Even though the warning light has been illustrated in combination with the spinning machine 9000 or with the suction device 12000, the present invention is not limited to this solution and the warning light can be carried out in combination with any spinning machine or suction device described.

[0104] It is also possible to exploit the various embodiments proposed to detect the presence of the textile element or of the tear on every single spinning element, in order to obtain a general system for detecting failures in the spinning machine and manage said information for a more general control and monitoring of the operation of the spinning machine. For example, by connecting the sensors 7601 and/or 10602 and/or the position sensors 12802 to a control unit, it is possible to know the number of spinning points 1200 having a tear in real time. It is

also possible to record the data in such a way as to have a complete view of the operation of the spinning machine over time.

[0105] In all of the embodiments previously described, it is also possible to include a pressure sensor, not illustrated herein, that measures the suction pressure generated by the suction element 1402. The output value of the pressure sensor can then be compared with a reference value through a comparator and the resulting difference indicated by the comparator can be used to pilot the suction element 1402, thus obtaining an automatic control cycle that makes it possible to maintain the pressure inside the suction pipe 1403 at a desired value, and advantageously reducing the power consumption of the suction element 1402 that, in the presence, for example, of a suction opening completely closed by the suction control element 2404 reduces the suction flow rate and thus its own consumption.

[0106] Furthermore, in the embodiments described above reference has been made to spinning machines 2000-12000, in order to make the description easier. Nevertheless, the present invention does not require a complete spinning machine to be provided, and other embodiments of the present invention may even refer only to components of the spinning machines 2000-12000 described herein.

[0107] For example, other embodiments of the present invention may refer only to the suction control elements, in particular the suction control elements 2404, 3404, 11404, possibly in combination with one or more of the actuators described, in particular the actuators 2405, 4405, 5405, 6405, 7405, 11405, 12405, possibly in combination with one or more of the sensors described, in particular the sensors 7601, 10602.

[0108] By way of example, it will thus be possible to have embodiments corresponding to a suction device for a spinning machine suited to spin a textile element 1301, 1302, as described with reference to any of the spinning machines 2000-12000. The spinning machine may comprise a spinning point 1200 for spinning the textile element, a suction element 1402 and a suction pipe 1403, on which the suction device may be mounted. The suction device can thus be produced and marketed independently of the spinning machine and can comprise a suction opening 1401 suited to be positioned in proximity to the textile element 1301, 1302 and a suction control element, for example any of those described as the suction control elements 2404, 3404, 11404, suited to be set at least in an open configuration and in a closed configuration, wherein in the open configuration the suction control element allows the suction element 1402 to draw through the suction opening 1401 and in the closed configuration the suction control element 2404, 3404, 11404 prevents the suction element 1402 from drawing through the suction opening 1401. It is clear that the assembly on the suction pipe 1403, where necessary, can be made in different manners, for example by providing, on the side of the suction device, a short pipe slightly larger or smaller

than the pipe 1403, so that it can be fixed to the pipe 1403. The suction device can furthermore comprise an actuator, for example any of those described as the actuators 2405, 4405, 5405, 6405, 7405, 11405, 12405, suited to operate the suction control element, configured in such a way as to set the suction control element in the open configuration in the presence of at least one tear in the textile element and to set the suction control element in the closed configuration if there are no tears in the textile element.

[0109] In addition to the above, in some embodiments of the present invention it is possible to make one or more holes upstream of the suction control element, in such a way as to guarantee an air flow towards the suction element, even in the case where all of the suction control elements are in the completely closed configuration. This is particularly advantageous in the case of some suction elements 1402 that may suffer damages caused by operation with no possibility of air flow. Furthermore, the presence of said hole/s makes it possible to guarantee a minimum air flow, so as to ensure that the suction pipe can be cleaned. An example of embodiment is represented by the suction holes 12901, which can be made in the suction device of the spinning machine 12000 or in any other suction device and/or spinning machine described herein.

[0110] Alternatively or in addition to the above, such minimum suction action can be obtained by guaranteeing an opening 12902 by means of the suction control element 11404. Said opening can be obtained with a suction control element 11404 having such a size that it does not come into contact with the suction pipe 1403, at least on one side. Alternatively or in addition to the above, it is possible to make holes in the suction control element 11404. Alternatively or in addition to the above, it is possible to adjust the opening 12902 by appositely adjusting the stop element 12501, as described above. It is clear that said solutions can be implemented in the suction device of the spinning machine 12000 or in any other suction device and/or spinning machine described herein.

[0111] Furthermore, in other variant embodiments, suitable combinations of the solutions described above with reference to the various embodiments may be provided. It has thus been shown through the present description that the invention allows the set objects to be achieved and/or the problems existing in the state of the art to be solved.

[0112] Even though the present invention has been illustrated above through the detailed description of some embodiments of the same, represented in the attached drawings, the present invention is not limited to the embodiments described above and represented in the drawings; on the contrary, further variant embodiments fall within the scope of the present invention, which is defined in the claims.

[0113] In the embodiments described herein, the suction control element 2404, 11404 has been described as

being a component that is separate from the suction opening 1401. The present invention, however, is not limited to this case and, alternatively, these two elements can be a single component.

Claims

1. Suction device for a spinning machine for spinning a textile element (1301, 1302), comprising:

- a suction opening (1401) suited to be positioned in proximity to the textile element (1301, 1302);
- a suction control element (2404, 11404) suited to be set at least in an open configuration and in a closed configuration;
- an actuator (2405, 4405, 5405, 6405, 7405, 11405, 12405) suited to operate the suction control element (2404, 11404), configured so as to set the suction control element in the open configuration in the presence of at least one tear in the textile element and to set the suction control element (2404, 11404) in the closed configuration when there are no tears in the textile element,

wherein the actuator (2405, 4405, 5405, 6405, 11405, 12405) is a mechanical actuator (2405, 4405, 5405, 6405, 11405, 12405), **wherein** the actuator (2405, 4405, 5405, 6405, 11405, 12405) comprises a feeler (4405D, 5405D, 11405D), **wherein** in the absence of tears in the textile element (1301, 1302), the feeler (4405D, 5405D, 11405D) is maintained against the textile element (1301, 1302), thus preventing the actuator (2405, 4405, 5405, 6405, 11405, 12405) from moving, **characterized in that** the feeler (4405D, 5405D, 11405D) is positioned on the side of the textile element (1301, 1302) that is opposite the suction opening (1401).

2. Suction device according to claim 1, **wherein** in the closed configuration the suction control element (2404, 11404) completely prevents a suction element (1402) from drawing through the suction opening (1401), or **wherein** in the closed configuration the suction control element (2404, 11404) forms an opening (12902) allowing a reduced suction action.

3. Suction device according to claim 1 or 2, **wherein** the suction control element (2404, 11404) is a valve, preferably a butterfly valve, or a ball valve, or a gate valve.

4. Suction device according to claim 1, **wherein** the feeler (4405D, 5405D, 11405D) is maintained against the textile element (1301, 1302) by a force generated by the weight of the actuator (2405, 4405,

5405, 6405, 11405, 12405) and/or by a force generated by the weight of the suction control element (2404, 11404).

5. Suction device according to claim 4, **wherein** the suction control element (2404, 11404) is made in an asymmetrical manner, so as to exert a force resulting in a rotation of the actuator (2405, 4405, 5405, 6405, 11405, 12405). 5
6. Suction device according to any of the claims from 1 to 5, **wherein** the actuator (6405, 12405) comprises at least one adjustable stop element (6501, 6502, 12501, 12502) suited to limit the movement of the actuator (6405, 12405) within a predetermined region. 10
7. Suction device according to any of the preceding claims, furthermore comprising at least one suction hole (12901) located upstream of the suction control element (2404, 11404). 15
8. Suction device according to any of the preceding claims, **wherein** the spinning machine or the suction device furthermore comprises a warning light (9902), **wherein** the warning light is configured in such a way that it lights up when the suction control element (2404, 11404) is set in the substantially open configuration. 20
9. Spinning machine comprising at least one spinning point (1200) for spinning a textile element and a suction device according to any of the preceding claims. 25
10. Spinning machine according to claim 9, **wherein** the spinning machine furthermore comprises: 30
 - a cutting element (8701) suited to cut the textile element (1301, 1302); and
 - an actuator (8702) suited to operate the cutting element (8701). 35
11. Spinning machine according to claim 10, **wherein** 40
 - the actuator (8702) for activating the cutting element (8701) is activated by the actuator (2405, 4405, 5405, 6405, 11405, 12405) for activating the suction control element (2404, 11404); or **wherein**
 - the actuator (8702) for activating the cutting element (8701) and the actuator (2405, 4405, 5405, 6405, 11405, 12405) for activating the suction control element (2404, 11404) are a single actuator. 45
12. Spinning machine according to claim 10, **wherein** the actuator (7405) for activating the suction control element (2404, 11404) is configured in such a way 50

as to set the suction control element in the closed configuration after a predetermined time from the activation of the cutting element by means of the actuator (8702) for activating the cutting element (8701).

Patentansprüche

1. Saugvorrichtung für eine Spinnmaschine zum Spinnen eines textilen Elements (1301, 1302), Folgendes umfassend:

- eine Ansaugöffnung (1401), dazu geeignet, in der Nähe des textilen Elements (1301, 1302) positioniert zu werden;
- ein Saugsteuerelement (2404, 11404), dazu geeignet, wenigstens in eine offene und in eine geschlossene Konfiguration versetzt zu werden;
- einen Aktuator (2405, 4405, 5405, 6405, 7405, 11405, 12405), dazu geeignet, das Saugsteuerelement (2404, 11404) zu betätigen, dazu konfiguriert, das Saugsteuerelement in die offene Konfiguration zu versetzen, wenn wenigstens ein Riss in dem textilen Element vorhanden ist, und das Saugsteuerelement (2404, 11404) in die geschlossene Konfiguration zu versetzen, wenn keine Risse in dem textilen Element vorhanden sind,

wobei der Aktuator (2405, 4405, 5405, 6405, 11405, 12405) ein mechanischer Aktuator (2405, 4405, 5405, 6405, 11405, 12405) ist, **wobei** der Aktuator (2405, 4405, 5405, 6405, 11405, 12405) einen Fühler (4405D, 5405D, 11405D) umfasst, **wobei** bei Fehlen von Rissen in dem textilen Element (1301, 1302) der Fühler (4405D, 5405D, 11405D) an das textile Element (1301, 1302) anliegend gehalten wird und damit die Bewegung des Aktuators (2405, 4405, 5405, 6405, 11405, 12405) verhindert wird, **dadurch gekennzeichnet, dass** der Fühler (4405D, 5405D, 11405D) an der Seite des textilen Elements (1301, 1302) positioniert ist, die der Ansaugöffnung (1401) entgegengesetzt ist.

2. Saugvorrichtung nach Patentanspruch 1, **wobei** das Saugsteuerelement (2404, 11404) in der geschlossenen Konfiguration die Ansaugung durch ein Saugelement (1402) durch die Ansaugöffnung (1401) vollständig verhindert, oder **wobei** das Saugsteuerelement (2404, 11404) in der geschlossenen Konfiguration eine Öffnung (12902) bildet, die eine reduzierte Saugwirkung erlaubt. 50
3. Saugvorrichtung nach Patentanspruch 1 oder 2, **wobei** das Saugsteuerelement (2404, 11404) ein Ventil ist, vorzugsweise eine Drosselklappe oder ein Kugelventil oder ein Absperrventil. 55

4. Saugvorrichtung nach Patentanspruch 1, **wobei** der Fühler (4405D, 5405D, 11405D) durch eine Kraft, die durch das Gewicht des Aktuators (2405, 4405, 5405, 6405, 11405, 12405) erzeugt wird und/oder durch eine Kraft, die durch das Gewicht des Saugsteuerelements ((2404, 11404) erzeugt wird, an das textile Element (1301, 1302) anliegend gehalten wird. 5
5. Saugvorrichtung nach Patentanspruch 4, **wobei** das Saugsteuerelement (2404, 11404) asymmetrisch ausgeführt ist, um eine Kraft auszuüben, die eine Drehung des Aktuators (2405, 4405, 5405, 6405, 11405, 12405) bewirkt. 10
6. Saugvorrichtung nach einem jeglichen der Patentansprüche von 1 bis 5, wobei der Aktuator (6405, 12405) wenigstens ein verstellbares Anschlagelement (6501, 6502, 12501, 12502) umfasst, dazu geeignet, die Bewegung des Aktuators (6405, 12405) innerhalb eines vorbestimmten Bereichs zu begrenzen. 15
7. Saugvorrichtung nach einem jeden der vorstehenden Patentansprüche, des Weiteren wenigstens ein stromaufwärts des Saugsteuerelements (2404, 11404) positioniertes Ansaugloch (12901) umfassend. 25
8. Saugvorrichtung nach einem jeden der vorstehenden Patentansprüche, **wobei** die Spinnmaschine oder die Saugvorrichtung des Weiteren eine Warnleuchte (9902) umfasst, **wobei** die Warnleuchte so konfiguriert ist, dass sie aufleuchtet, wenn das Saugsteuerelement (2404, 11404) in die im Wesentlichen offene Konfiguration versetzt ist. 30 35
9. Spinnmaschine, wenigstens einen Spinnpunkt (1200) zum Spinnen eines textilen Elements und eine Saugvorrichtung nach einem jeden der vorstehenden Patentansprüche umfassend. 40
10. Spinnmaschine nach Patentanspruch 9, **wobei** die Spinnmaschine des Weiteren Folgendes umfasst: 45
- ein Schneidelement (8701), dazu geeignet, das textile Element (1301, 1302) zu schneiden; und
 - einen Aktuator (8702), dazu geeignet, das Schneidelement (8701) zu betätigen. 50
11. Spinnmaschine nach Patentanspruch 10, **wobei**
- der Aktuator (8702) zur Aktivierung des Schneidelements (8701) durch den Aktuator (2405, 4405, 5405, 6405, 11405, 12405) zur Aktivierung des Saugsteuerelements (2404, 11404) aktiviert wird, oder **wobei** 55

- der Aktuator (8702) zur Aktivierung des Schneidelements (8701) und der Aktuator (2405, 4405, 5405, 6405, 11405, 12405) zur Aktivierung des Saugsteuerelements (2404, 11404) ein einziger Aktuator sind.

12. Spinnmaschine nach Patentanspruch 10, **wobei** der Aktuator (7405) zur Aktivierung des Saugsteuerelements (2404, 11404) dazu konfiguriert ist, das Saugsteuerelement nach einer vorbestimmten Zeit ab der Aktivierung des Schneidelements durch den Aktuator (8702) zur Aktivierung des Schneidelements (8701) in die geschlossene Konfiguration zu versetzen.

Revendications

1. Dispositif d'aspiration pour un appareil de filage apte à filer un élément textile (1301, 1302) comprenant:
- une ouverture d'aspiration (1401) pouvant être positionnée à proximité de l'élément textile (1301, 1302) ; et
 - un élément de contrôle de l'aspiration (2404, 3404, 11404) indiqué pour être positionné dans au moins une configuration ouverte et dans une configuration fermée ;
 - un actionneur (2405, 4405, 5405, 6405, 7405, 11405, 12405) apte à actionner l'élément de contrôle de l'aspiration (2404, 11404), configuré de manière à positionner l'élément de contrôle de l'aspiration dans la configuration ouverte à la présence d'au moins une déchirure dans l'élément textile et positionner l'élément de contrôle de l'aspiration (2404, 11404) dans la configuration fermée en l'absence de déchirures dans l'élément textile,
- où l'actionneur (2405, 4405, 5405, 6405, 11405, 12405) est un actionneur mécanique (2405, 4405, 5405, 6405, 11405, 12405), **où** l'actionneur (2405, 4405, 5405, 6405, 11405, 12405) comprend un palpeur (4405D, 5405D, 11405D), **où** en l'absence de déchirures dans l'élément textile (1301, 1302), le palpeur (4405D, 5405D, 11405D) est maintenu contre l'élément textile (1301, 1302), empêchant ainsi le mouvement de l'actionneur (2405, 4405, 5405, 6405, 11405, 12405), **caractérisé en ce que** le palpeur (4405D, 5405D, 11405D) est positionné sur le côté de l'élément textile (1301, 1302) qui est opposé à l'ouverture d'aspiration (1401).
2. Dispositif d'aspiration selon la revendication 1, **où** dans la configuration fermée l'élément de contrôle de l'aspiration (2404, 11404) évite l'aspiration complète par l'élément d'aspiration (1402) de l'ouverture d'aspiration (1401), ou **où** l'élément de contrôle de

l'aspiration (2404, 3404, 11404) dans la configuration fermée forme une ouverture (12902) permettant une aspiration réduite.

3. Dispositif d'aspiration selon la revendication 1 ou 2, **où** l'élément d'aspiration (2404, 11404) est une soupape, préférablement une vanne papillon, ou une vanne à boule, ou un robinet-vanne. 5
4. Dispositif d'aspiration selon la revendication 1, **où** le palpeur (4405D, 5405D, 11405D) est maintenu contre l'élément textile (1301, 1302) par une force générée par le poids de l'actionneur (2405, 4405, 5405, 6405, 11405, 12405) et/ou par une force générée par le poids de l'élément de contrôle de l'aspiration (2404, 11404). 10
5. Dispositif d'aspiration selon la revendication 4, **où** l'élément de contrôle de l'aspiration (2404, 11404) est réalisé de manière asymétrique, de façon à exercer une force qui provoque une rotation de l'actionneur (2405, 4405, 5405, 6405, 11405, 12405). 15
6. Dispositif selon l'une quelconque des revendications de 1 à 5, **où** l'actionneur (6405, 12405) comprend au moins un élément d'arrêt réglable (6501, 6502, 12501, 12502) indiqué pour limiter le mouvement de l'actionneur (6405, 12405) à l'intérieur d'une zone prédéterminée. 20
7. Dispositif d'aspiration selon l'une quelconque des revendications précédentes, comprenant en outre au moins un trou (12901) se trouvant en amont de l'élément de contrôle de l'aspiration (2404, 11404). 25
8. Dispositif d'aspiration selon l'une quelconque des revendications précédentes, **où** l'appareil de filage ou le dispositif d'aspiration comprend également un témoin lumineux (9902), **où** le témoin lumineux est configuré de manière à ce qu'il s'allume quand l'élément de contrôle de l'aspiration (2404, 11404) est positionné dans la configuration essentiellement ouverte. 30
9. Appareil de filage comprenant au moins un point de filage (1200) pour le filage d'un élément textile et un dispositif d'aspiration selon l'une quelconque des revendications précédentes. 35
10. Appareil de filage selon la revendication 9, **où** l'appareil de filage comprend en outre : 40
 - un élément de coupe (8701) indiqué pour couper l'élément textile (1301, 1302) ; et
 - un actionneur (8702) indiqué pour actionner l'élément de coupe (8701). 45

11. Appareil de filage selon la revendication 10, **où**

- l'actionneur (8702) pour actionner l'élément de coupe (8701) est actionné par l'actionneur (2405, 4405, 5405, 6405, 11405, 12405) pour actionner l'élément de contrôle de l'aspiration (2404, 11404) ; ou **où**
 - l'actionneur (8702) pour actionner l'élément de coupe (8701) et l'actionneur (2405, 4405, 5405, 6405, 11405, 12405) pour actionner l'élément de contrôle de l'aspiration (2404, 11404) sont un actionneur unique.

12. Appareil de filage selon la revendication 10, **où** l'actionneur (7405) pour actionner l'élément de contrôle de l'aspiration (2404, 11404) est configuré de manière à positionner l'élément de contrôle de l'aspiration dans la configuration fermée après un temps prédéterminé à partir de l'activation de l'élément de coupe par l'actionneur (8702) pour actionner l'élément de coupe (8701).

Fig. 1A

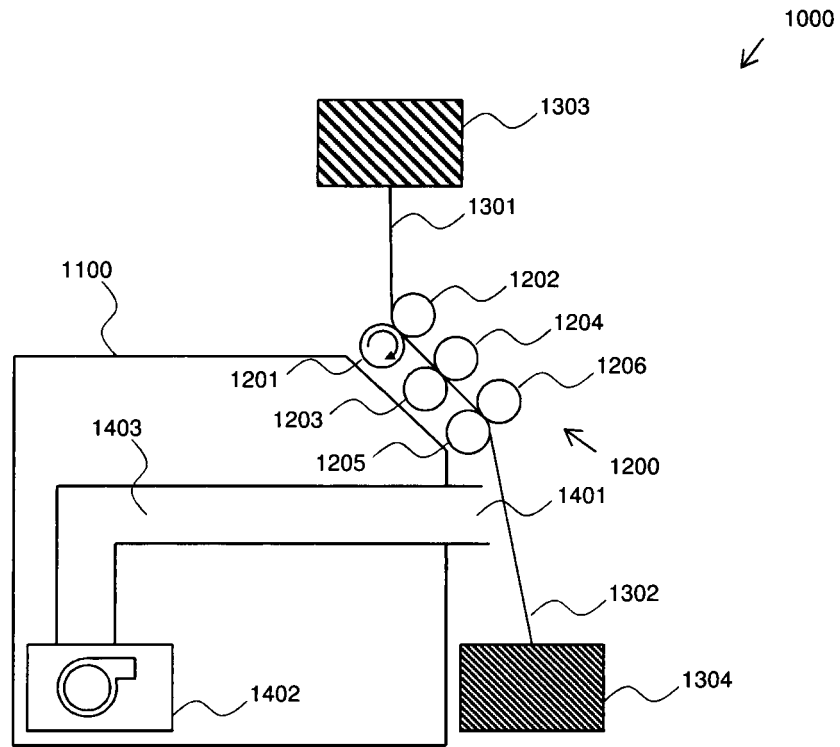


Fig. 1B

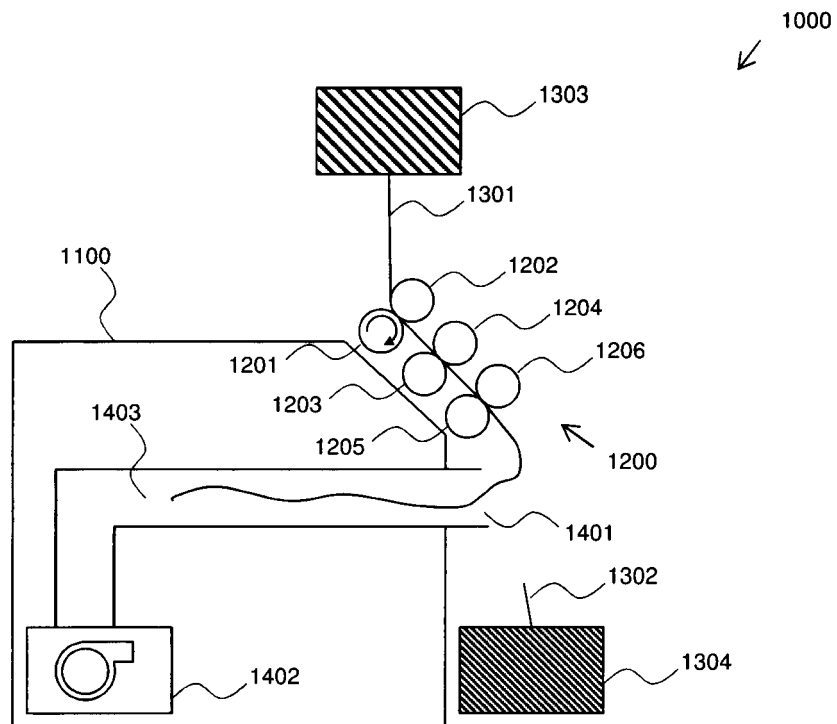


Fig. 2A

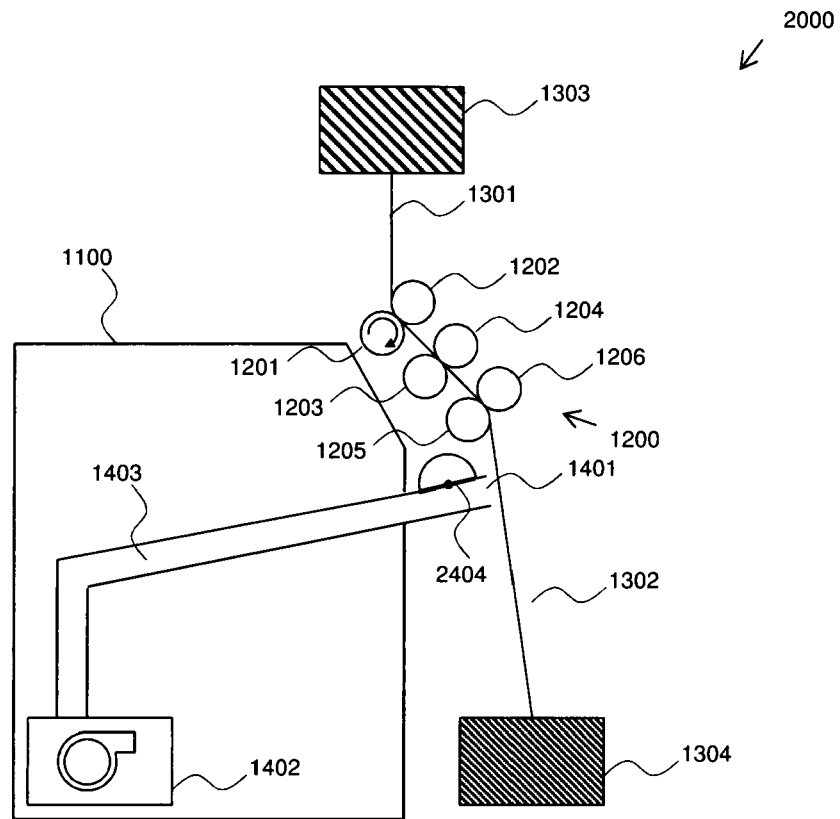


Fig. 2B

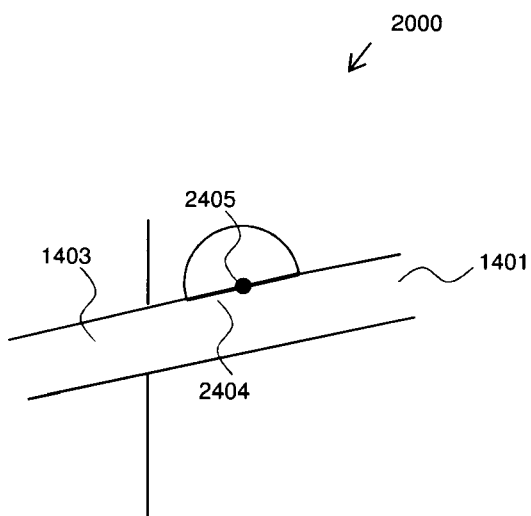


Fig. 2C

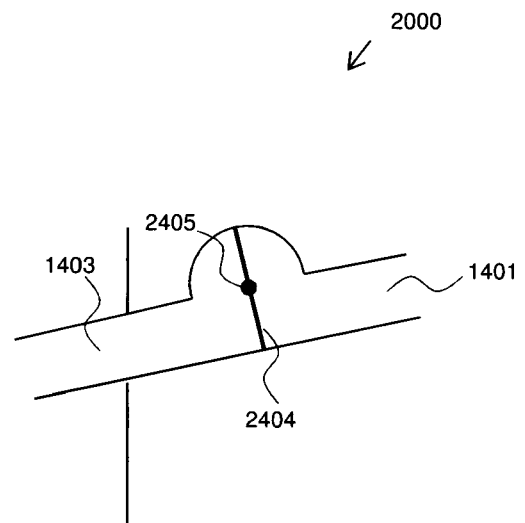


Fig. 3A

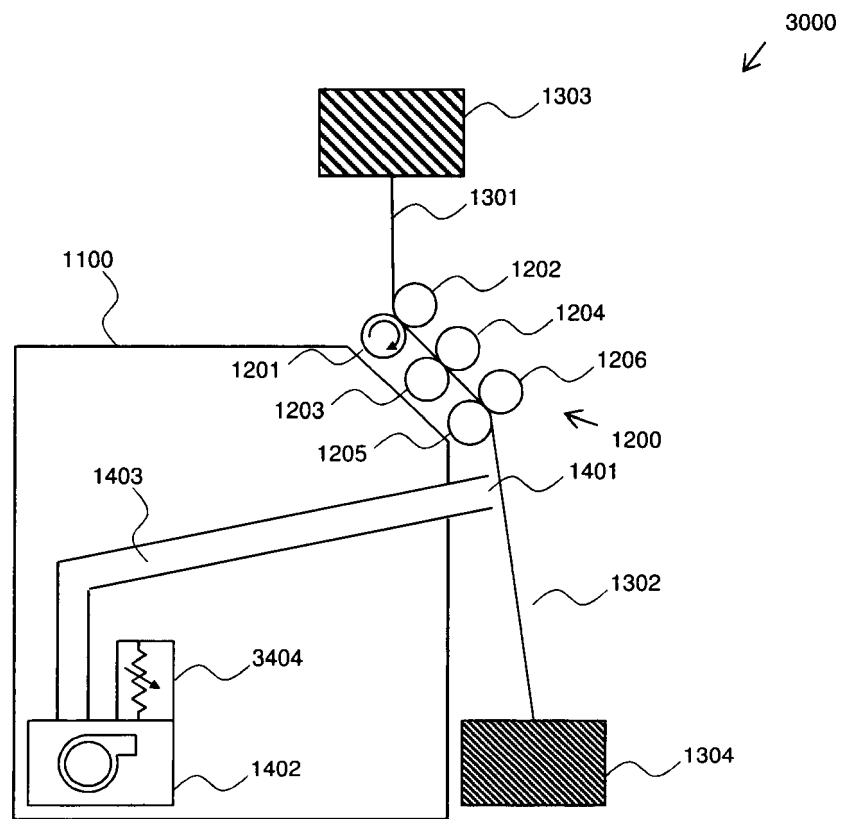


Fig. 4A

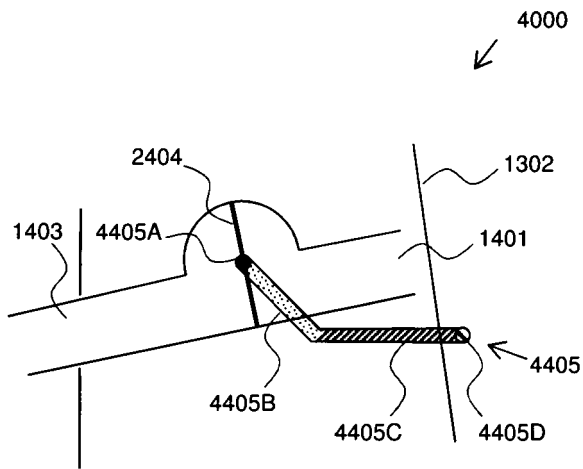


Fig. 4B

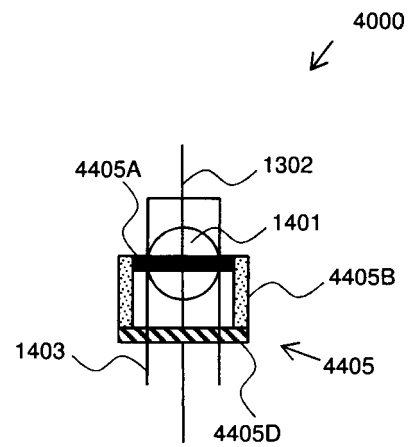


Fig. 4C

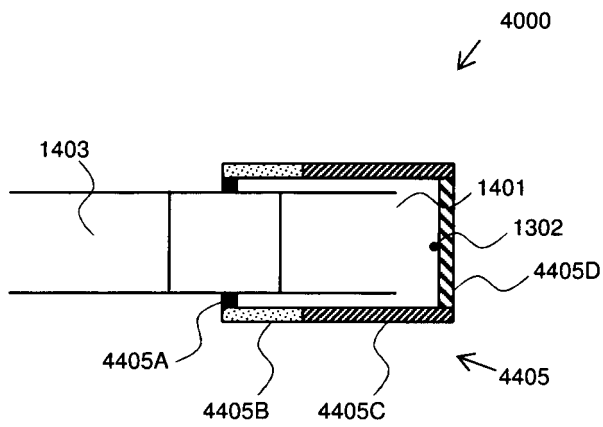


Fig. 4D

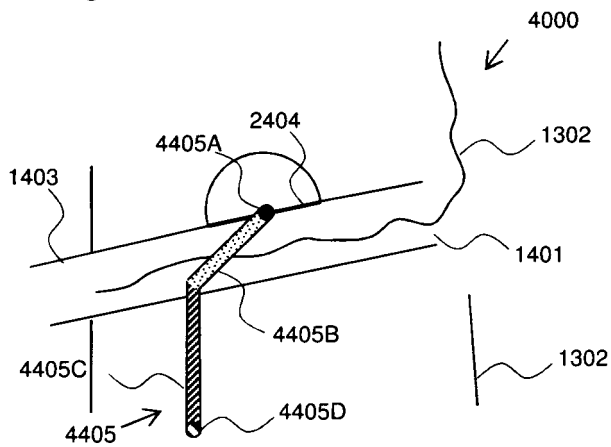


Fig. 5A

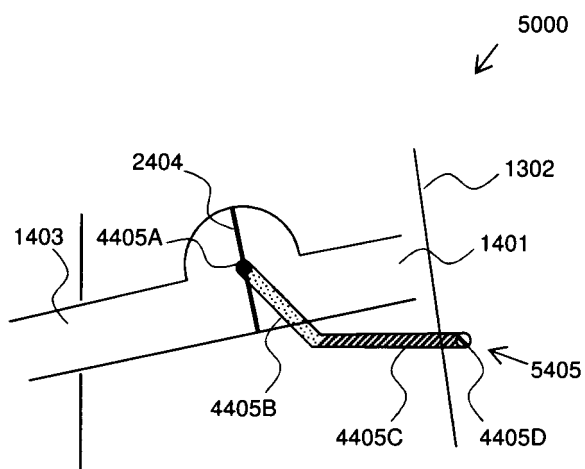


Fig. 5B

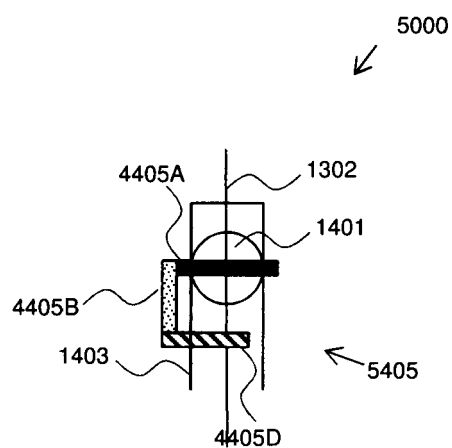


Fig. 5C

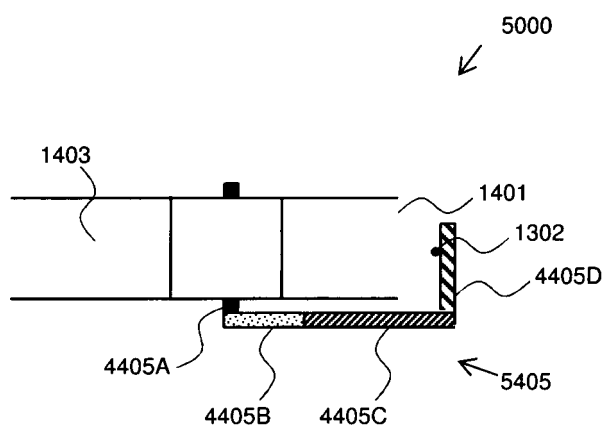


Fig. 5D

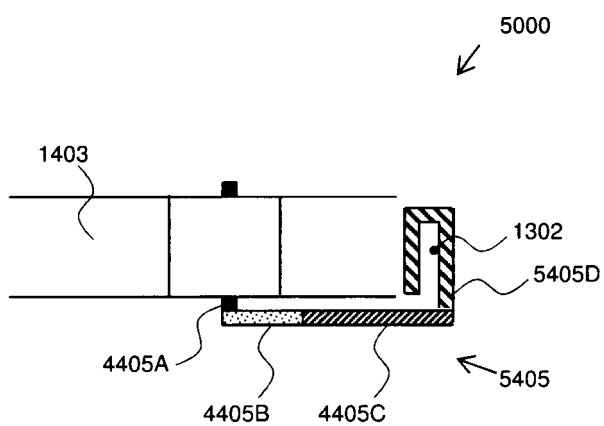


Fig. 6A

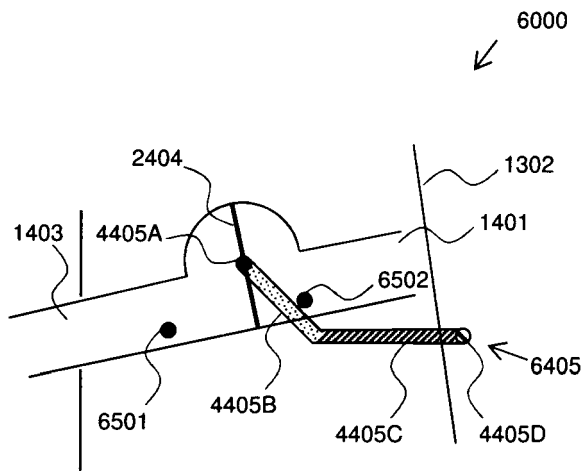


Fig. 6B

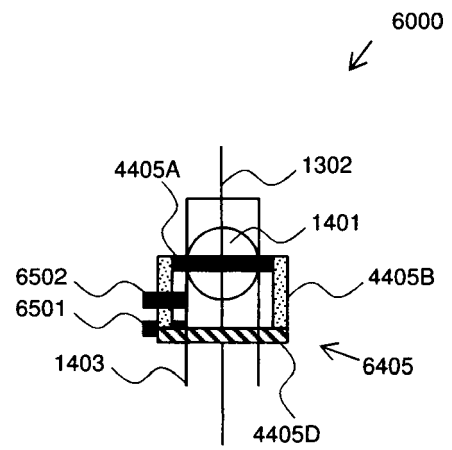


Fig. 6C

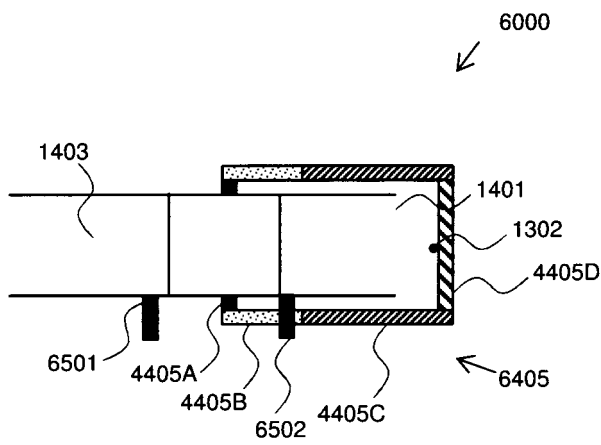


Fig. 6D

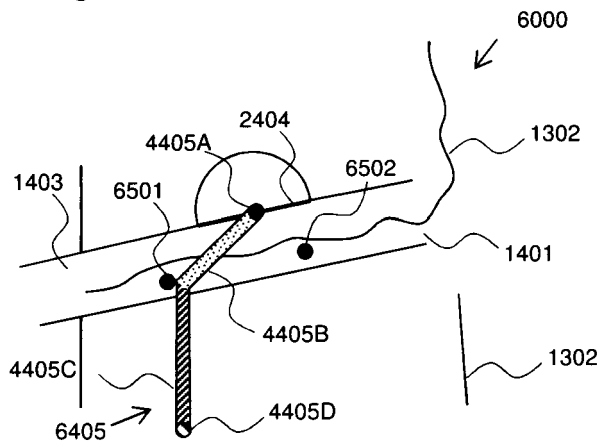


Fig. 7A

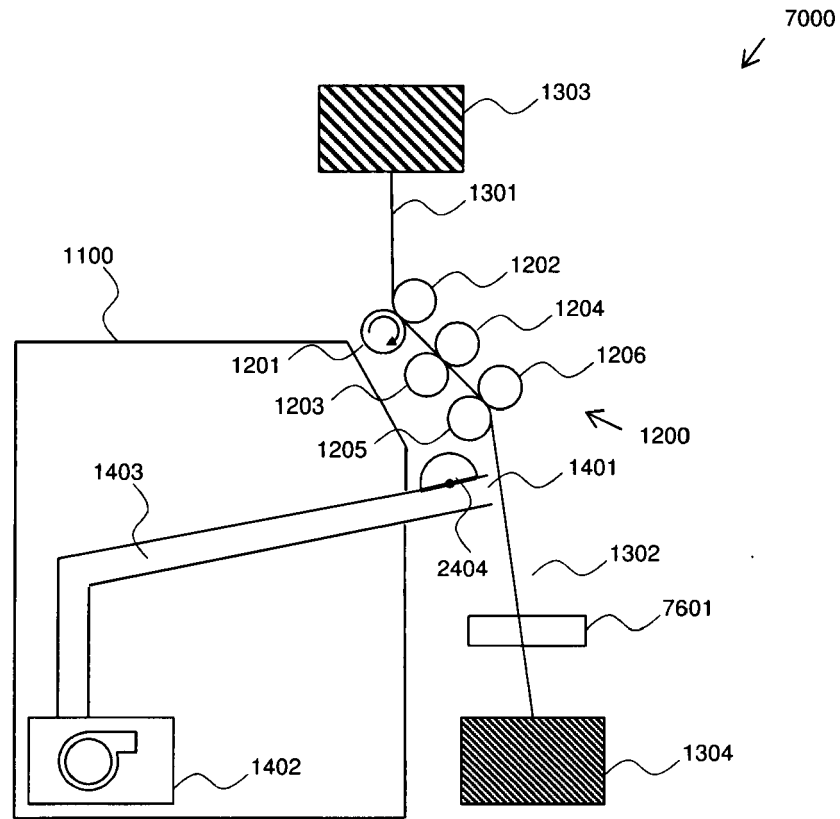


Fig. 7B

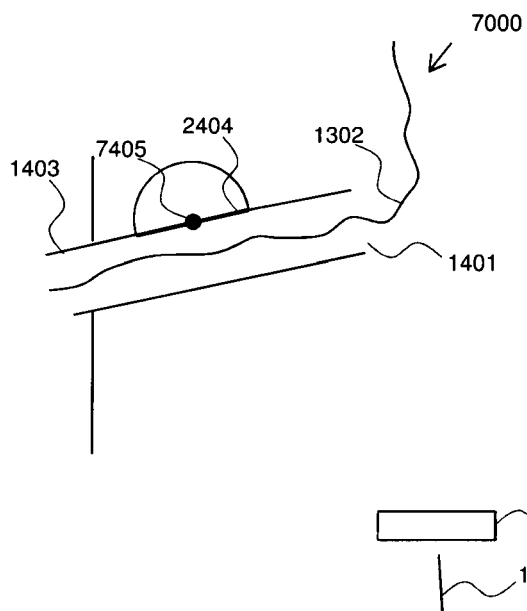


Fig. 7C

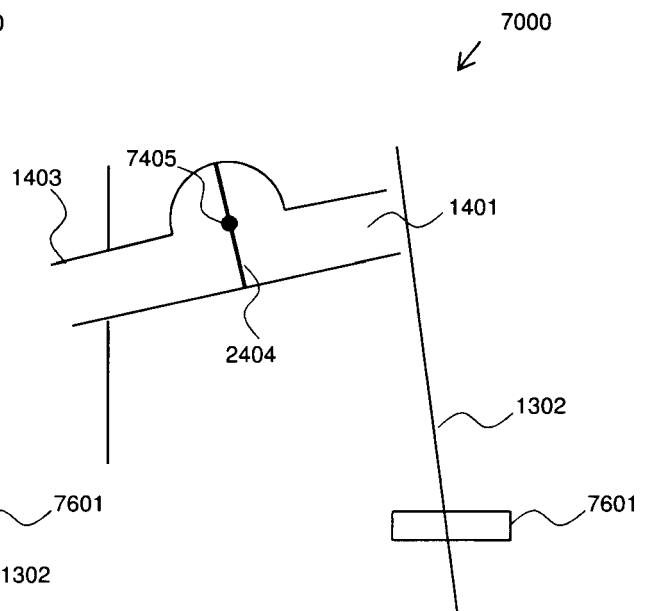


Fig. 8A

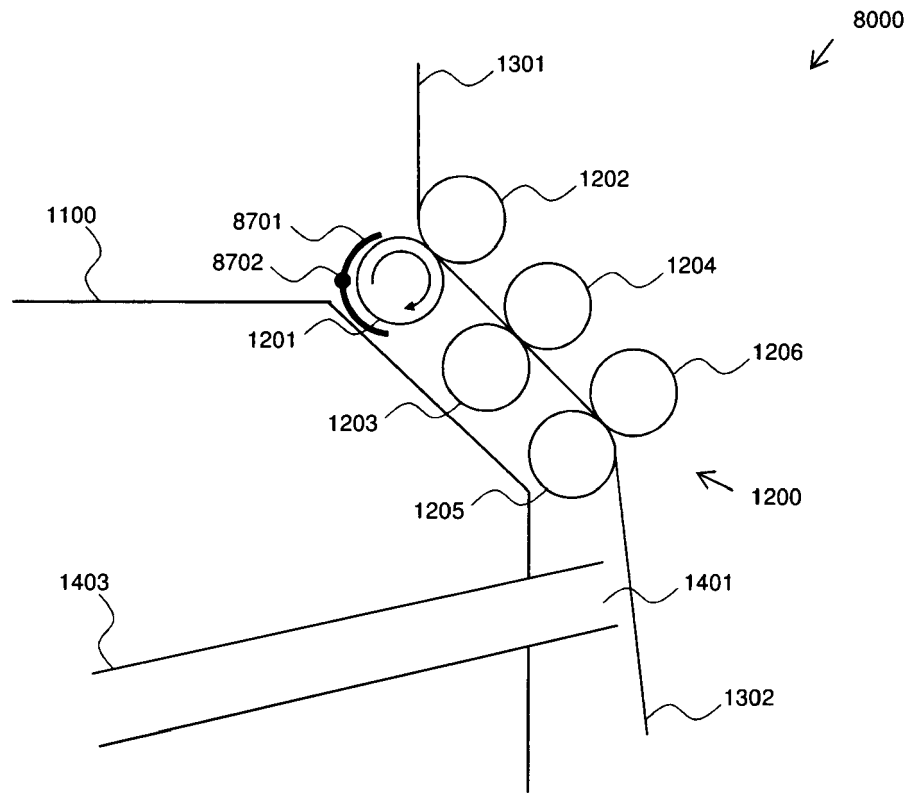


Fig. 8B

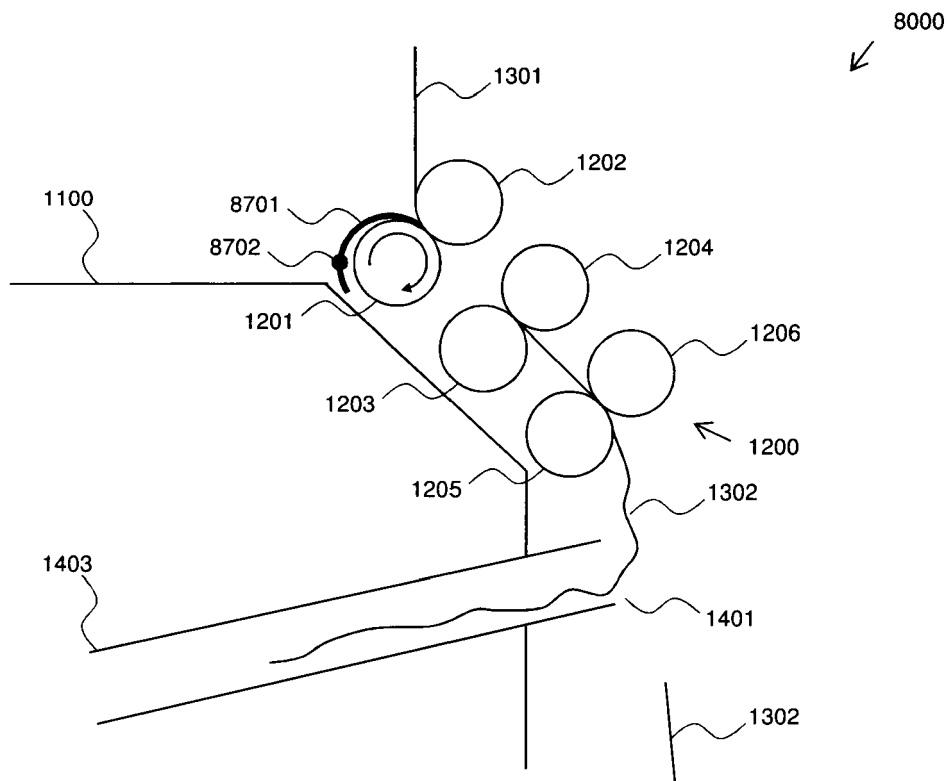


Fig. 9A

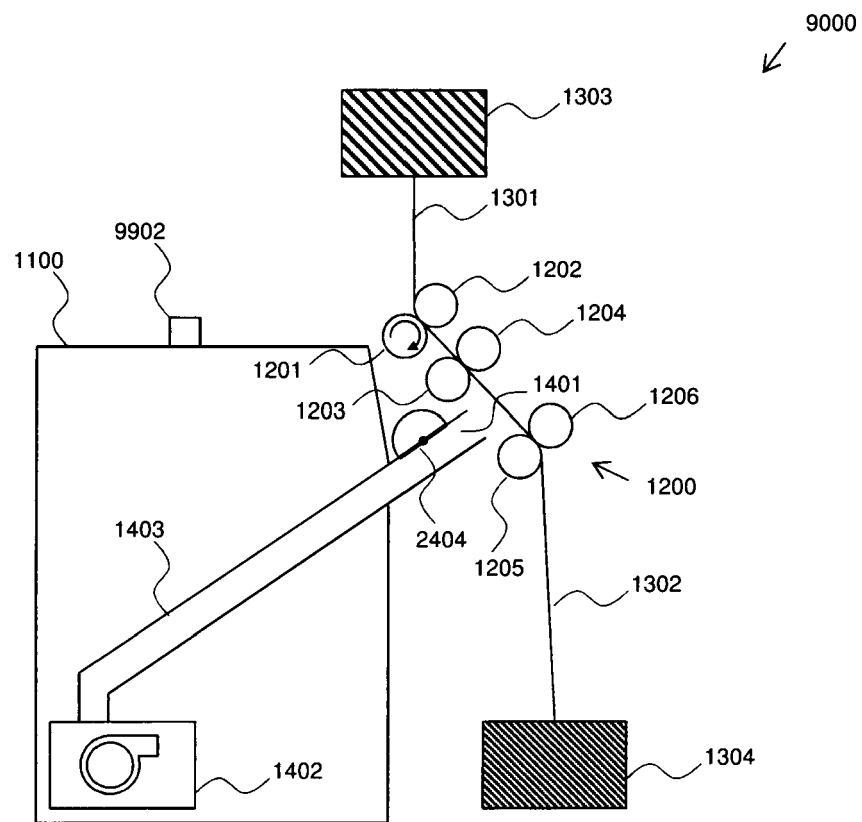


Fig. 10A

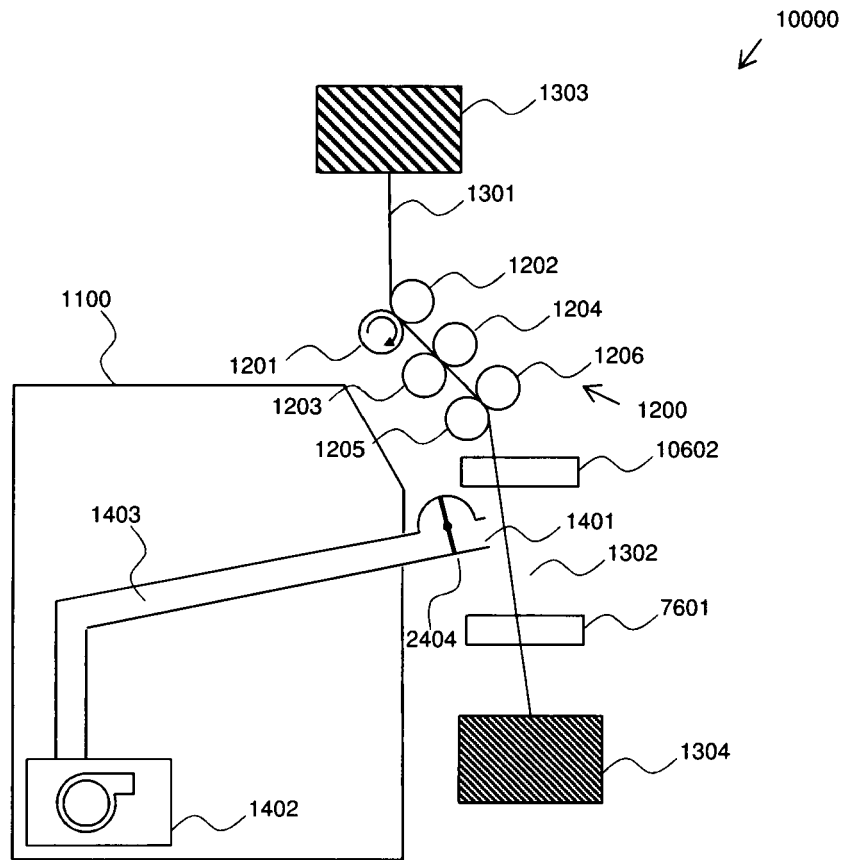


Fig. 10B

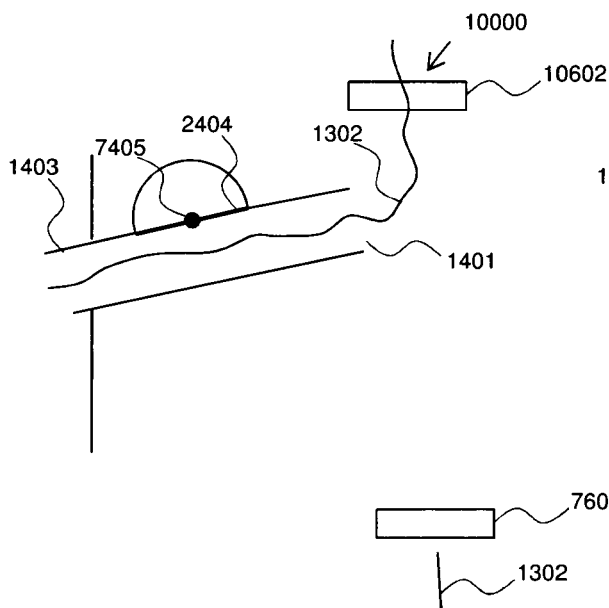


Fig. 10C

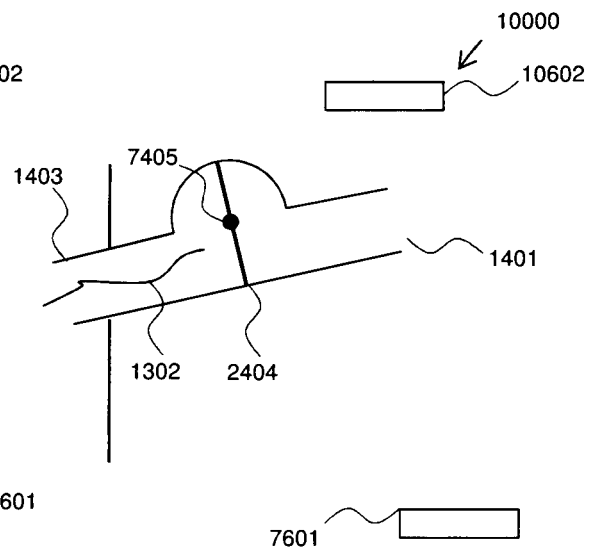


Fig. 11A

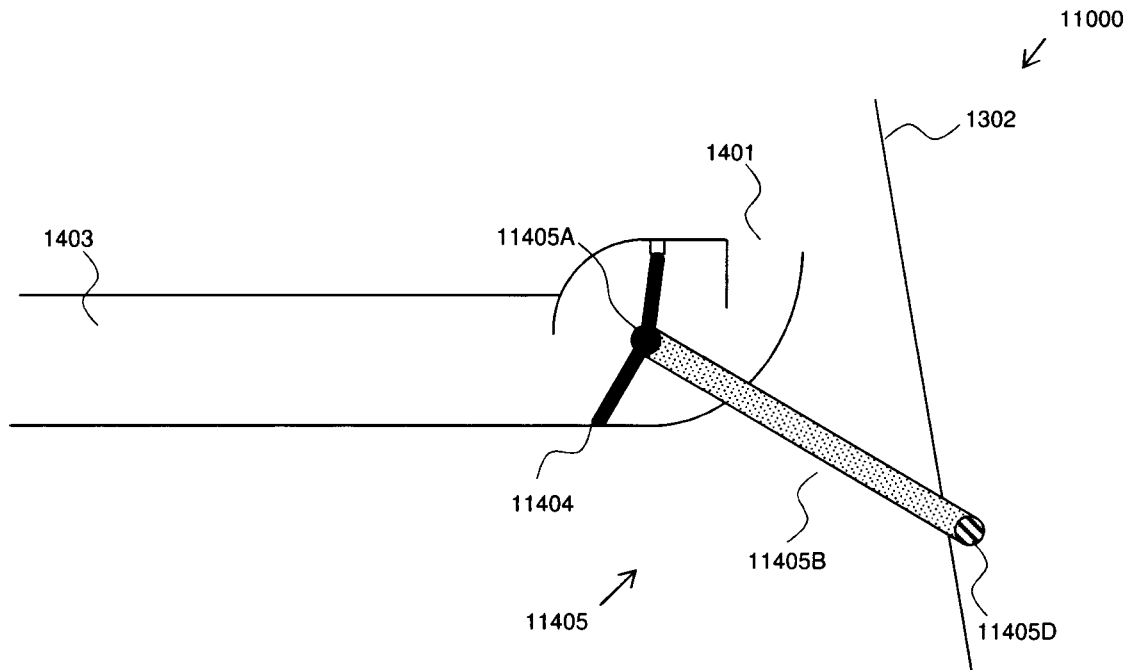


Fig. 11B

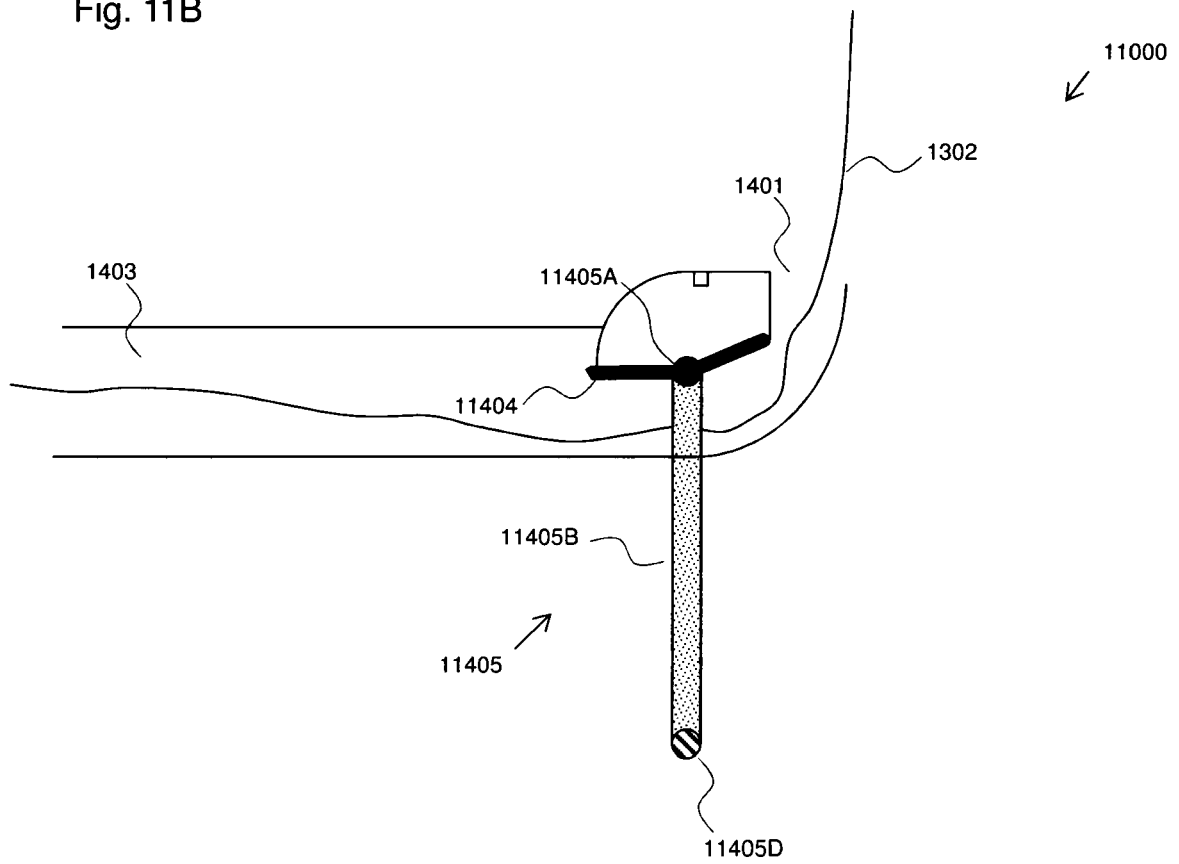


Fig. 12A

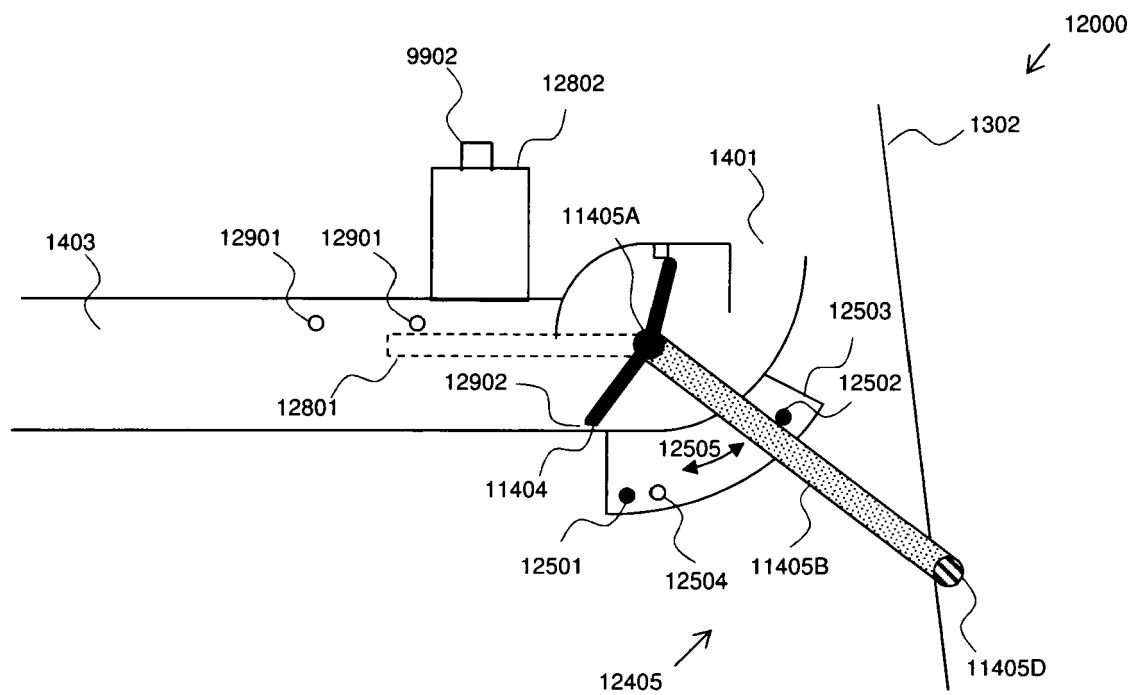
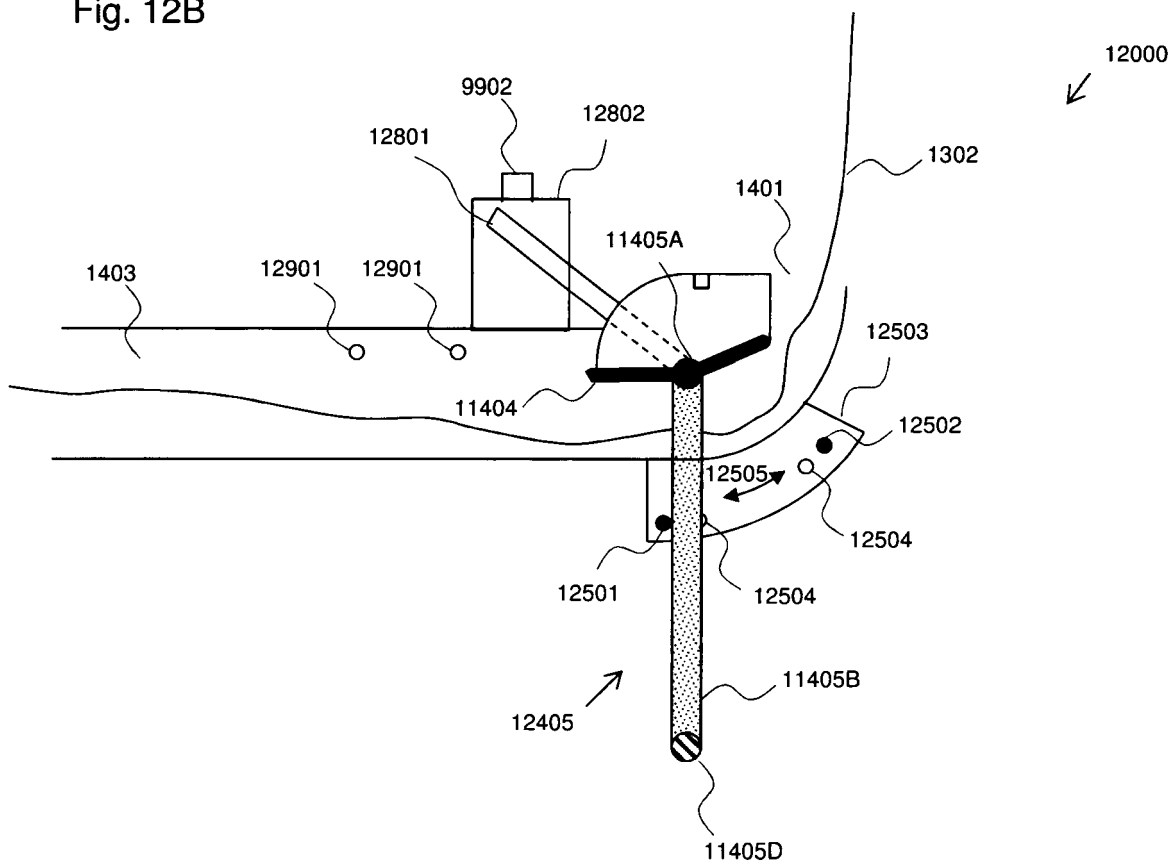


Fig. 12B



REFERENCES CITED IN THE DESCRIPTION

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