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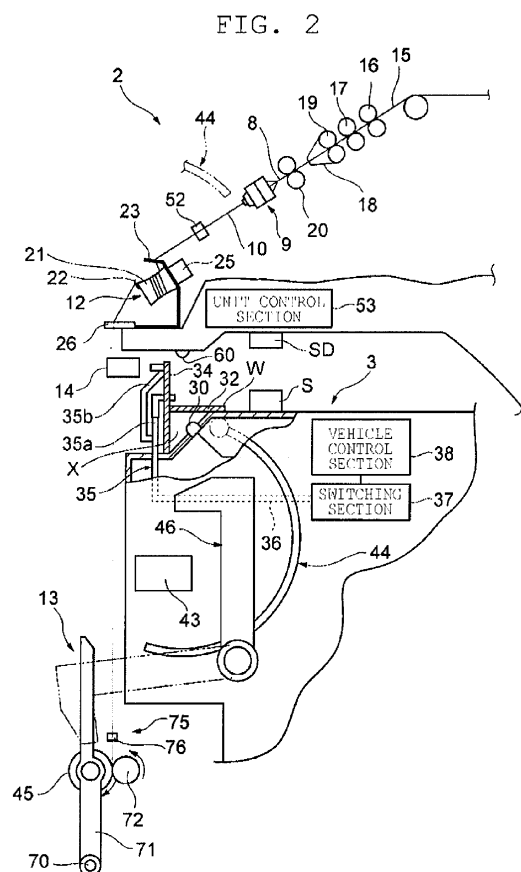
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(54) **Spinning machine**

(57) A spinning machine (1) includes a unit communication section (60) provided for each of a plurality of spinning units (2); a vehicle communication section (30) provided for a yarn joining vehicle (3) and adapted to perform non-contact communication with the unit communication section (60); and a cleaning section adapted to perform cleaning of the vehicle communication section (30), where the cleaning section performs the cleaning of the vehicle communication section (30) during a period of time from when the yarn joining vehicle (3) passes a spinning unit (2) located a prescribed number of units in advance from a target spinning unit (2) which is to be serviced by the yarn joining vehicle (3) and until when the unit communication section (60) and the vehicle communication section (30) start communication at the target spinning unit (2).



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a spinning machine including a plurality of spinning units, and a service vehicle adapted to travel among the plurality of spinning units.

2. Description of the Related Art

[0002] For example, Japanese Unexamined Patent Publication No. 2005-330596 describes a spinning machine adapted to produce a yarn. The spinning machine includes a plurality of spinning units, and a plurality of service vehicles adapted to travel among the plurality of spinning units. When a yarn cut occurs in the spinning unit, one of the service vehicles travels to the spinning unit in which the yarn cut occurred to perform a yarn joining operation of the cut yarn. The service vehicle includes a sensor adapted to prevent collision with another service vehicle.

BRIEF SUMMARY OF THE INVENTION

[0003] In each spinning unit, fluffs (fiber dusts) may be generated in a process of producing the yarn. If such fluffs accumulate on the sensor and the like arranged in the service vehicle, failures of the sensor and the like may occur.

[0004] It is an object of the present invention to provide a spinning machine adapted to prevent occurrence of failures caused by the fluffs.

[0005] A spinning machine according to the present invention includes a plurality of spinning units and a service vehicle adapted to travel among the spinning units, each spinning unit including a yarn supplying section adapted to supply a yarn and a winding section adapted to wind the yarn into a package, the spinning machine including a first communication section provided for each of the spinning units; a second communication section provided for the service vehicle and adapted to perform non-contact communication with the first communication section; and a cleaning section adapted to start cleaning of at least one of the first communication section and the second communication section during a period of time from when the service vehicle passes a spinning unit located a prescribed number of units in advance from a target spinning unit which is to be serviced by the service vehicle and until when the first communication section and the second communication section start communication at the target spinning unit.

[0006] Thus, in the spinning machine, the fluffs accumulated on at least one of the first communication section and the second communication section can be cleaned and removed by the cleaning section before the first com-

munication section and the second communication start communication. Therefore, in the spinning machine, the first communication section and the second communication section can communicate. The occurrence of failures caused by the fluffs thus can be prevented in the spinning machine.

[0007] According to one embodiment, the cleaning section is adapted to start cleaning of at least one of the first communication section and the second communication section during a period of time from when the service vehicle passes a spinning unit next to the target spinning unit and until when the first communication section and the second communication section start communication. Therefore, for example, the accumulated fluffs can be cleaned before the service vehicle arrives at the target spinning unit. The occurrence of failures caused by the fluffs thus can be more reliably prevented in the spinning machine.

[0008] According to one embodiment, the service vehicle preferably includes at least a portion of the cleaning section. According to such a configuration, the configuration can be simplified compared to the configuration in which the cleaning section is arranged in each spinning unit.

[0009] According to one embodiment, the cleaning section is adapted to determine that the service vehicle passed one spinning unit when a reference portion (reference position) of the service vehicle passes a reference portion (reference position) of such a spinning unit, and to clean at least one of the first communication section and the second communication section in accordance with a determination result. The cleaning section thus can perform the cleaning at an appropriate timing.

[0010] According to one embodiment, the cleaning section may have a configuration including a blow nozzle adapted to blow air to at least one of the first communication section and the second communication section; an air supplying section adapted to supply the air to the blow nozzle; a switching section adapted to switch between supplying of the air and shutting off of the supplying of the air to the blow nozzle from the air supplying section; and a control section adapted to control switching of the switching section. According to such a configuration, in the spinning machine, the fluffs accumulated on at least one of the first communication section and the second communication section can be easily removed with the air blown from the blow nozzle.

[0011] According to one embodiment, each of the spinning units includes a waxing device adapted to apply wax to the yarn supplied from the yarn supplying section, and the cleaning section further cleans the waxing device of the target spinning unit before the service vehicle performs service to the target spinning unit. According to such a configuration, in the spinning machine, the fluffs and/or waste of wax accumulated on the waxing device can be removed. Furthermore, in the spinning machine, the air is prevented from being blown to the yarn since the waxing device is cleaned before the service vehicle

performs service. Therefore, the yarn can be prevented from deviating from the waxing device (yarn path).

[0012] According to one embodiment, a first nozzle adapted to blow the air to at least one of the first communication section and the second communication section, and a second nozzle adapted to blow the air to the waxing device may be integrally arranged as the blow nozzle. According to such a configuration, in the spinning machine, the configuration can be simplified even in a configuration in which the air is blown from the blow nozzle to a plurality of areas.

[0013] According to one embodiment, the spinning machine includes a frame adapted to form a travelling space of the service vehicle below the yarn supplying section in a machine height direction. When the service vehicle travels below the yarn supplying section, the fluffs tend to easily accumulate on the service vehicle. Thus, in such a configuration, it is particularly advantageous if the service vehicle includes the cleaning section.

[0014] According to one embodiment, the service vehicle is a yarn joining vehicle adapted to perform a yarn joining operation of the yarn supplied from the yarn supplying section, and the yarn from the package when the yarn is disconnected, and the cleaning section cleans at least one of the first communication section and the second communication section during the yarn joining operation. According to such a configuration, in the spinning machine, the yarn joining vehicle and the spinning unit can more reliably communicate, and for example, information necessary for the yarn joining operation, and the like can be transmitted and received.

[0015] According to one embodiment, the yarn supplying section may include a draft device adapted to draft a fiber bundle; and a pneumatic spinning device adapted to twist the fiber bundle using a whirling airflow and to produce the yarn.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIG. 1 is a front view of a spinning machine according to one embodiment;

FIG. 2 is a view illustrating a cross-sectional configuration of the spinning machine illustrated in FIG. 1; and

FIG. 3 is a front view illustrating a part of the spinning machine in an enlarged manner.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0017] Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. The same reference numerals are denoted on the same or corresponding components in the description of the drawings, and the redundant description will be omitted. "Upstream"

and "downstream" respectively refer to upstream and downstream in a travelling direction of a yarn during spinning.

[0018] A spinning machine 1 as a textile machine illustrated in FIG. 1 includes a plurality of spinning units 2 arranged in line. The spinning machine 1 includes a yarn joining vehicle (service vehicle) 3, a blower box 80, and a motor box 5. The motor box 5 includes a machine control device (not illustrated) adapted to perform control of the entire spinning machine 1. In a factory where the spinning machine 1 is installed, a work passage extending in a direction in which the spinning units 2 are arranged is provided at a yarn path side of the yarn joining vehicle 3. The operator can perform operation, monitoring, and the like of each spinning unit 2 from the work passage.

[0019] As illustrated in FIG. 1, each spinning unit 2 includes a draft device 7, a pneumatic spinning device 9, a yarn accumulating device 12, a waxing device 14, and a winding device (winding section) 13 arranged in this order from upstream to downstream. The draft device 7 and the pneumatic spinning device 9 configure a yarn supplying section adapted to supply a spun yarn 10 to the winding device 13.

[0020] The draft device 7 is arranged in the vicinity of an upper end of a housing (frame) 6 of the spinning machine 1 in a machine height direction of the spinning machine 1. A fiber bundle 8 (see FIG. 2) fed from the draft device 7 is spun by the pneumatic spinning device 9. The spun yarn 10 fed from the pneumatic spinning device 9 is passed through a yarn clearer 52, fed further downstream by the yarn accumulating device 12, and applied with wax in the waxing device 14. Thereafter, the spun yarn 10 is wound by the winding device 13, and a package 45 is formed.

[0021] The draft device 7 drafts a sliver 15 to obtain the fiber bundle 8. As illustrated in FIG. 2, the draft device 7 includes four roller pairs, i.e., a back roller pair 16, a third roller pair 17, a middle roller pair 19 provided with an apron belt 18, and a front roller pair 20. A bottom roller of each of the roller pairs 16, 17, 19, and 20 is driven by power from the motor box 5, or by power of electric motors (not illustrated) arranged individually. Each of the roller pairs 16, 17, 19, and 20 is driven with a different rotation speed, and as a result, the sliver 15 supplied from the upstream can be drafted into the fiber bundle 8, and fed to the pneumatic spinning device 9 located downstream.

[0022] The pneumatic spinning device 9 applies twists to the fiber bundle 8 using a whirling airflow to produce the spun yarn 10. Although detailed description and illustration will be omitted, the pneumatic spinning device 9 includes a fiber guiding section, a whirling airflow generating nozzle, and a hollow guide shaft body. The fiber guiding section guides the fiber bundle 8 fed from the draft device 7 to a spinning chamber formed inside the pneumatic spinning device 9. The whirling airflow generating nozzle is arranged at a periphery of a path of the fiber bundle 8 to generate the whirling airflow in the spin-

ning chamber. This whirling airflow causes fiber ends of the fiber bundle 8 in the spinning chamber to be reversed and to whirl. The hollow guide shaft body guides the spun yarn 10 from the spinning chamber to an outside of the pneumatic spinning device 9.

[0023] The yarn accumulating device 12 is arranged downstream of the pneumatic spinning device 9. The yarn accumulating device 12 has a function of applying a predetermined tension to the spun yarn 10 to pull out the spun yarn 10 from the pneumatic spinning device 9, a function of accumulating the spun yarn 10 fed from the pneumatic spinning device 9 during a yarn joining operation by the yarn joining vehicle 3 to prevent slackening of the spun yarn 10, and a function of adjusting the tension such that a fluctuation of the tension at the winding device 13 side is not transmitted towards the pneumatic spinning device 9. As illustrated in FIG. 2, the yarn accumulating device 12 includes a yarn accumulating roller 21, a yarn hooking member 22, an upstream guide 23, an electric motor 25, and a downstream guide 26.

[0024] The yarn hooking member 22 can be engaged (hooked) with the spun yarn 10. The yarn hooking member 22 integrally rotates with the yarn accumulating roller 21 while being engaged with the spun yarn 10 to wind the spun yarn 10 around an outer peripheral surface of the yarn accumulating roller 21.

[0025] The yarn accumulating roller 21 can have a prescribed amount of the spun yarn 10 wound around the outer peripheral surface thereof to accumulate the spun yarn 10. The yarn accumulating roller 21 is rotatably driven by the electric motor 25. When the yarn accumulating roller 21 is rotated, the spun yarn 10 wound around the outer peripheral surface of the yarn accumulating roller 21 is wound so as to tighten the yarn around the accumulating roller 21, and the spun yarn 10 located upstream of the yarn accumulating device 12 is pulled. In other words, when the yarn accumulating roller 21 is rotated at a predetermined rotation speed with the spun yarn 10 wound around the outer peripheral surface of the yarn accumulating roller 21, the yarn accumulating device 12 can apply a predetermined tension to the spun yarn 10 and pull out the spun yarn 10 at a predetermined speed from the pneumatic spinning device 9, and transport the spun yarn 10 towards the downstream at a predetermined speed.

[0026] The upstream guide 23 is arranged slightly upstream of the yarn accumulating roller 21. The upstream guide 23 appropriately guides the spun yarn 10 with respect to the outer peripheral surface of the yarn accumulating roller 21. The upstream guide 23 prevents the twist of the spun yarn 10 propagating from the pneumatic spinning device 9 from being transmitted downstream of the upstream guide 23.

[0027] The yarn clearer 52 is arranged on a front side (work passage side) of the housing 6 of the spinning machine 1, and at a position between the pneumatic spinning device 9 and the yarn accumulating device 12. The spun yarn 10 spun by the pneumatic spinning device 9

passes through the yarn clearer 52 before being wound by the yarn accumulating device 12. The yarn clearer 52 monitors a thickness of the travelling spun yarn 10 and/or presence or absence of foreign substances contained in the spun yarn 10, and transmits a yarn defect detection signal to a unit control section 53 arranged in the spinning unit 2 when a yarn defect of the spun yarn 10 is detected.

[0028] Upon receiving the yarn defect detection signal, the unit control section 53 immediately stops ejection of compressed air from the whirling airflow generating nozzle of the pneumatic spinning device 9. The whirling airflow is then stopped, the twisting of the fiber bundle 8 is stopped, and introduction of the fiber bundle 8 to the pneumatic spinning device 9 is also stopped. A continuation of the fibers is disconnected in the pneumatic spinning device 9, and the spun yarn 10 is cut. Thereafter, the unit control section 53 further stops the draft device 7 and the like.

[0029] The unit control section 53 transmits a control signal to a vehicle control section 38 of the yarn joining vehicle 3, and the yarn joining vehicle 3 travels to the front of the relevant spinning unit 2. Thereafter, the pneumatic spinning device 9 and the like are driven again, the yarn joining vehicle 3 performs the yarn joining operation, and winding is resumed. In this case, after the pneumatic spinning device 9 resumes the spinning and until the winding of the package 45 is resumed, the yarn accumulating device 12 accumulates the spun yarn 10 continuously fed from the pneumatic spinning device 9 on the yarn accumulating roller 21 to eliminate the slackening of the spun yarn 10.

[0030] As illustrated in FIG. 1, a rail 41 is arranged along the direction in which the spinning units 2 are arranged. The yarn joining vehicle 3 has wheels 42, and travels on the rail 41. A travelling space of the yarn joining vehicle 3 is formed in the housing 6. The travelling space is located below the draft device 7, the pneumatic spinning device 9, and the like. The yarn joining vehicle 3 travels through the travelling space.

[0031] The yarn joining vehicle 3 includes a splicer (yarn joining device) 43, a suction pipe (first catching-and-guiding section) 44, and a suction mouth (second catching-and-guiding section) 46. When a yarn breakage or a yarn cut occurs in a spinning unit 2, the yarn joining vehicle 3 travels along the rail 41 to the relevant spinning unit 2 and stops. While being swung vertically with a shaft as a center, the suction pipe 44 sucks and catches a yarn end fed from the pneumatic spinning device 9, and guides the yarn end to the splicer 43. While being swung vertically with a shaft as the center, the suction mouth 46 sucks and catches a yarn end from the package 45 supported by the winding device 13, and guides the yarn end to the splicer 43. The splicer 43 joins the guided yarn ends.

[0032] A unit communication section (first communication section) 60 adapted to perform optical communication is arranged on the housing 6, and is arranged at a position facing the yarn joining vehicle 3. A vehicle com-

munication section (second communication section) 30 adapted to perform optical communication is arranged in the yarn joining vehicle 3. The unit communication section 60 and the vehicle communication section 30 perform optical communication (non-contact communication) to exchange information (e.g. recognize a spinning unit number) between the spinning unit 2 and the yarn joining vehicle 3.

[0033] As illustrated in FIG. 2, the yarn joining vehicle 3 includes a detection sensor S adapted to detect the position of the spinning unit 2. The detection sensor S is arranged at a central part (reference position, reference portion), for example, of the yarn joining vehicle 3 in the travelling direction of the yarn joining vehicle 3. The position of arranging the detection sensor S is not particularly limited as long as it is a position capable of detecting a sensor detecting section SD (reference position, reference portion), to be described later.

[0034] The detection sensor S detects the sensor detecting section SD arranged in the housing 6 of the spinning machine 1 to detect and acquire the position of each spinning unit 2. In each spinning unit 2, the sensor detecting section SD is arranged at a position (reference position, reference portion) facing the detection sensor S when the yarn joining vehicle 3 is located at the relevant spinning unit 2. For example, as illustrated in FIG. 3, in a projected figure, the sensor detecting section SD is arranged at a position including the yarn path of the spun yarn 10. The yarn joining vehicle 3 acquires its own position in accordance with a serial number of the spinning unit 2 detected by the detection sensor S and a travel control signal.

[0035] The waxing device 14 is arranged downstream of the yarn accumulating device 12. The waxing device 14 applies wax to the spun yarn 10 travelling from the yarn accumulating device 12 towards the winding device 13.

[0036] The winding device 13 includes a cradle arm 71 supported to be swingable about a supporting shaft 70. The cradle arm 71 rotatably supports a bobbin 48 for winding the spun yarn 10.

[0037] The winding device 13 includes a winding drum 72 and a traverse device 75. The winding drum 72 is adapted to be driven while making contact with an outer peripheral surface of the bobbin 48 or an outer peripheral surface of the package 45 formed by winding the spun yarn 10. The traverse device 75 includes a traverse guide 76 capable of being engaged with the spun yarn 10. The winding device 13 drives the winding drum 72 with an electric motor (not illustrated) while reciprocating the traverse guide 76 by a driving means (not illustrated). The package 45 making contact with the winding drum 72 can be rotated and the spun yarn 10 can be wound into the package 45 while the spun yarn 10 is being traversed. The traverse guide 76 of the traverse device 75 is commonly driven in each spinning unit 2 by a common shaft for the plurality of spinning units 2.

[0038] The blower box 80 stores therein an air supply-

ing section (air supplying section, cleaning section) 81 adapted to generate air to be supplied to each section of the spinning unit 2, the yarn joining vehicle 3, and the like.

[0039] An installment structure of the vehicle communication section 30 will now be described. The yarn joining vehicle 3 includes a recess X at a position facing the unit communication section 60 of the spinning unit 2. An upper side and the yarn path side of the recess X are opened. The vehicle communication section 30 is installed in the recess X.

[0040] The recess X is covered by a transparent cover 32 formed in a flat plate shape. The cover 32 is located between the yarn supplying section (the draft device 7 and the pneumatic spinning device 9) and the vehicle communication section 30. The opening on the upper side of the recess X is thereby sealed by the cover 32. The cover 32 receives the fluffs falling from the draft device 7, the pneumatic spinning device 9, and the like.

[0041] The cover 32 intersects with a straight line connecting the unit communication section 60 and the vehicle communication section 30 during communication of the unit communication section 60 and the vehicle communication section 30. In other words, the cover 32 is arranged between the unit communication section 60 and the vehicle communication section 30. The unit communication section 60 and the vehicle communication section 30 communicate via the cover 32.

[0042] A bracket 34 having a flat plate shape is fixed to the yarn joining vehicle 3 so as to cover the opening of the recess X, the opening of which is facing the yarn path of the spun yarn 10. The upper part of the vehicle communication section 30 is covered by the cover 32, and the side or a space around the side of the vehicle communication section 30 is covered by the bracket 34.

[0043] The upper end of the bracket 34 extends higher than the cover 32. A blow nozzle (cleaning section) 35 adapted to blow air is fixed to the bracket 34. The blow nozzle 35 includes a first nozzle 35a adapted to blow air to the upper surface (fluff receiving surface) W of the cover 32, and a second nozzle 35b adapted to blow air to the waxing device 14. The ejection ports of the first nozzle 35a and the second nozzle 35b face opposite sides from one another. The second nozzle 35b is branched from the first nozzle 35a, for example. The first nozzle 35a and the second nozzle 35b are integrally arranged. The first nozzle 35a blows air to the cover 32. The direction of blowing air from the first nozzle 35a is the side opposite to the yarn path of the spun yarn 10. The second nozzle 35b blows air toward the yarn path of the spun yarn 10.

[0044] A switching section (cleaning section) 37 is connected to the blow nozzle 35 via a piping 36. The compressed air from the air supplying section 81 is supplied to the piping 36. The switching section 37 is adapted to switch between supplying and shutting off of the air from the air supplying section 81 to the blow nozzle 35. Instead of blowing the compressed air from the air supplying section 81 arranged in the blower box 80 from the blow nozzle

35, the air supplying section may be arranged in the yarn joining vehicle 3.

[0045] The yarn joining vehicle 3 includes a vehicle control section (cleaning section) 38 for performing at least one of control of travelling of the yarn joining vehicle 3, control of communication with the spinning unit 2 using the vehicle communication section 30, and control of the yarn joining operation by the splicer 43. When yarn breakage or yarn cut occurs in a spinning unit 2, the machine control device outputs the travel control signal to the yarn joining vehicle 3 thus causing the yarn joining vehicle 3 to travel to the target spinning unit 2, which is to be serviced by the yarn joining vehicle 3. The vehicle control section 38 determines that the yarn joining vehicle 3 passed the spinning unit 2 when the detection sensor S (reference position, reference portion) of the yarn joining vehicle 3 passes the sensor detecting section SD (reference position, reference portion) of the spinning unit 2. The vehicle control section 38 controls the switching section 37 to control the switching operation between supplying and shutting off of the air from the air supplying section 81 to the blow nozzle 35.

[0046] Specifically, the vehicle control section 38 controls the switching section 37 to blow the air to the upper surface W of the cover 32 during a period of time from when the yarn joining vehicle 3 passes the spinning unit 2 located a prescribed number of units in advance from the spinning unit 2 to be serviced by the yarn joining vehicle 3 (in the present embodiment, the spinning unit 2 located one before (next spinning unit 2)) until when the communication with the unit communication section 60 of the target spinning unit 2 to be serviced by the yarn joining vehicle (hereinafter referred to as a target spinning unit 2) starts. The time the yarn joining vehicle 3 passes the spinning unit 2 is the time the detection sensor S of the yarn joining vehicle 3 passes the sensor detecting section SD installed for the relevant spinning unit 2, that is, the time the detection sensor S detects the sensor detecting section SD.

[0047] In other words, in the present embodiment, when the detection sensor S detects the sensor detecting section SD of the spinning unit 2 next to the target spinning unit 2, after the detection of the sensor detecting section SD (after passing the next spinning unit 2), the vehicle control section 38 controls the switching section 37 to blow the air from the blow nozzle 35 immediately before the unit communication section 60 and the vehicle communication section 30 start communication at the target spinning unit 2 in a range D illustrated in FIG. 3. The yarn joining vehicle 3 may be stopped or the yarn joining vehicle 3 may be moving immediately before the unit communication section 60 and the vehicle communication section 30 start communication.

[0048] Before the yarn joining vehicle 3 arrives and stops at the target spinning unit 2 and performs the yarn joining operation, the vehicle control section 38 controls the switching section 37 so as to blow the air to the waxing device 14 by the second nozzle 35b. In this case, in the

present embodiment, since the first nozzle 35a and the second nozzle 35b are integrally arranged, the air is also blown from the first nozzle 35a to the cover 32.

[0049] The vehicle control section 38 may control the switching section 37 such that the air is blown from the blow nozzle 35 towards the upper surface W of the cover 32 at the time of the yarn joining operation by the splicer 43. The time of the yarn joining operation includes at least one of the start of the yarn joining operation by the splicer 43 and during the yarn joining operation, and is merely required to be before the spun yarn 10 is passed through the waxing device 14. After the suction pipe 44 catches the spun yarn 10 spun from the pneumatic spinning device 9, and before the suction pipe 44 is swung downward to guide the spun yarn 10 to the splicer 43, the blowing of air from the blow nozzle 35 toward the upper surface W of the cover 32 is to be completed.

[0050] As described above, in the present embodiment, the cleaning section adapted to clean the vehicle communication section 30 is arranged. The cleaning section includes the blow nozzle 35 (the first nozzle 35a) adapted to blow air to the vehicle communication section 30, the air supplying section 81 adapted to supply air to the blow nozzle 35, the switching section 37 adapted to switch between supplying and shutting off of the air from the air supplying section 81 to the blow nozzle 35, and the vehicle control section 38 adapted to control the switching of the switching section 37.

[0051] The cleaning section starts to clean the vehicle communication section 30 during a period of time from when the yarn joining vehicle 3 passes the spinning unit 2 next to the target spinning unit 2 until when the unit communication section 60 and the vehicle communication section 30 start communication at the target spinning unit 2. Thus, in the spinning machine 1, before the unit communication section 60 and the vehicle communication section 30 start communication, the fluffs accumulated on the vehicle communication section 30 can be cleaned and removed by the cleaning section. Therefore, in the spinning machine 1, the unit communication section 60 and the vehicle communication section 30 can reliably communicate, and a failure in that the yarn joining vehicle 3 cannot recognize the spinning unit 2 to be serviced by the yarn joining vehicle can be prevented. Thus, the occurrence of failures caused by the fluffs can be prevented in the spinning machine 1.

[0052] The cleaning section performs the cleaning of at least one of the unit communication section 60 and the vehicle communication section 30 immediately before the unit communication section 60 and the vehicle communication section 30 start communication at the target spinning unit 2.

[0053] Before the unit communication section 60 and the vehicle communication section 30 start communication at the target spinning unit 2, the cleaning section stops the cleaning of the unit communication section 60 and the vehicle communication section 30.

[0054] In the present embodiment, at least a portion of

the cleaning section is provided at the yarn joining vehicle 3. Thus, in the spinning machine 1, the cleaning section is merely required to be arranged in the yarn joining vehicle 3, and hence the configuration can be simplified compared to the configuration of arranging the cleaning section in each spinning unit 2.

[0055] In the present embodiment, the vehicle control section 38 determines that the yarn joining vehicle 3 passed the spinning unit 2 when the detection sensor S of the yarn joining vehicle 3 detects the sensor detecting section SD of the spinning unit 2, and the cleaning section performs the cleaning of the vehicle communication section 30 in accordance with the determination result. According to such a configuration, in the spinning machine 1, a fact that the yarn joining vehicle 3 passed the relevant spinning unit 2 can be detected, and the cleaning section can perform the cleaning at an appropriate timing.

[0056] In the present embodiment, the vehicle control section 38 controls the switching section 37 such that the cleaning of the waxing device 14 of the target spinning unit 2 is performed before the yarn joining vehicle 3 performs the operation on the target spinning unit 2. According to such a configuration, in the spinning machine 1, the fluffs and/or wastes of wax accumulated in the waxing device 14 can be removed. In the spinning machine 1, since the waxing device 14 is cleaned before the yarn joining vehicle 3 performs the operation, the air is prevented from being blown on the spun yarn 10. Therefore, the spun yarn 10 can be prevented from deviating from the waxing device 14.

[0057] In the present embodiment, the first nozzle 35a adapted to blow air to the vehicle communication section 30 (the upper surface W of the cover 32) and the second nozzle 35b adapted to blow air to the waxing device 14 are integrally arranged as the blow nozzle 35. According to such a configuration, in the spinning machine 1, even in the configuration in which the air is blown to two areas from the blow nozzle 35, the configuration can be simplified.

[0058] The yarn joining vehicle 3 includes the suction pipe 44, the suction mouth 46, and the splicer 43. When the yarn 10 is disconnected, the suction pipe 44 catches and guides the yarn 10 spun from the pneumatic spinning device 9, and the suction mouth 46 catches and guides the yarn 10 leading to the package 45. The splicer 43 joins the guided yarns 10. The cleaning section completes the cleaning before the suction pipe 44 starts to guide the yarn 10 to the splicer 43 (before a downward movement from the catching position starts).

[0059] The present invention is not limited to the embodiment described above. For example, in the embodiment described above, a mode of cleaning the vehicle communication section 30 (the upper surface W of the cover 32) with the cleaning section has been described by way of example, but the unit communication section 60 may be cleaned with the cleaning section or the vehicle communication section 30 and the unit communication section 60 may be cleaned with the cleaning sec-

tion.

[0060] In the embodiment described above, the vehicle control section 38 controls the switching section 37 so as to blow air to the upper surface W of the cover 32 after the yarn joining vehicle 3 passes the spinning unit 2 next to the target spinning unit 2, but the timing to blow the air is not limited thereto. The vehicle control section 38 may control the switching section 37 so as to blow air to the upper surface W of the cover 32 after the yarn joining vehicle 3 passes the spinning unit 2 located a prescribed number of units in advance from the target spinning unit 2. The prescribed number of units may be appropriately set.

[0061] For example, when the prescribed number of units is set to two, if the yarn joining vehicle 3 is at the spinning unit 2 located two spinning units in advance from the target spinning unit 2, the vehicle control section 38 may control the switching section 37 so as to blow the air to the upper surface W of the cover 32 after the yarn joining vehicle 3 passes the spinning unit 2 located two spinning units in advance from the target spinning unit 2.

[0062] The vehicle control section 38 may control the switching section 37 so as to blow the air from the blow nozzle 35 after the service of the yarn joining operation by the yarn joining vehicle 3 and/or activation (start-up) of the spinning machine 1.

[0063] In the embodiment described above, the vehicle communication section 30 is arranged in the recess X, and the cover 32 is arranged to cover the recess X, but the installing mode of the vehicle communication section 30 is not limited thereto. The cover 32 may not be necessarily arranged.

[0064] In the embodiment described above, a configuration in which the first nozzle 35a adapted to blow the air to the upper surface W of the cover 32 (the vehicle communication section 30) and the second nozzle 35b adapted to blow the air to the waxing device 14 are integrally arranged has been described by way of example, but the first nozzle 35a and the second nozzle 35b may be independently arranged. In the case of such a configuration, the vehicle control section 38 may control the switching section 37 such that the air is blown from the first nozzle 35a towards the upper surface W of the cover 32 at the time of the yarn joining operation by the splicer 43. In this case, the time of the yarn joining operation includes at least one of the start of the yarn joining operation by the splicer 43, during the yarn joining operation, and the end of the yarn joining operation.

[0065] In the embodiment described above, the fluffs on the cover 32 are removed by the air blown from the blow nozzle 35, but are not limited to being removed by the blowing of the air. For example, a suction nozzle may be arranged in place of the blow nozzle 35, and the fluffs on the cover 32 may be removed through suction by the suction nozzle. For example, the fluffs on the cover 32 may be removed by a brush attached to the housing 6 of the spinning unit 2.

[0066] In the embodiment described above, one yarn

joining vehicle 3 is arranged with respect to one spinning machine 1, but a plurality of the yarn joining vehicles 3 may be arranged in accordance with the number of spinning units 2.

[0067] In the embodiment described above, the vehicle communication section 30 and the unit communication section 60 communicate using light, but they may communicate through other methods. The vehicle communication section 30 and the unit communication section 60 merely need to communicate in a contactless manner.

[0068] In the spinning machine 1, a nip roller and a delivery roller may be arranged in place of the yarn accumulating device 12, and the spun yarn 10 may be pulled out from the pneumatic spinning device 9 by such rollers.

[0069] In the embodiment described above, the splicer 43 has been described by way of example as the yarn joining device adapted to perform the yarn joining operation in the yarn joining vehicle 3, but the yarn joining device may be other mechanisms.

Claims

1. A spinning machine comprising a plurality of spinning units (2) and a service vehicle (3) adapted to travel among the spinning units (2), each spinning unit (2) including a yarn supplying section (7, 9) adapted to supply a yarn (10) and a winding section (13) adapted to wind the yarn (10) into a package (45), the spinning machine comprising:

a first communication section (60) provided for each of the spinning units (2);

a second communication section (30) provided for the service vehicle (3) and adapted to perform non-contact communication with the first communication section (30); **characterized by** a cleaning section (35, 37, 38, 81) adapted to start cleaning of at least one of the first communication section (60) and the second communication section (30) during a period of time from when the service vehicle (3) passes a spinning unit (2) located a prescribed number of units in advance from a target spinning unit (2) which is to be serviced by the service vehicle (3) and until when the first communication section (60) and the second communication section (30) start communication at the target spinning unit (2).

2. The spinning machine according to claim 1, **characterized in that** the cleaning section (35, 37, 38, 81) is adapted to start cleaning of at least one of the first communication section (60) and the second communication section (30) during a period of time from when the service vehicle (3) passes a spinning unit (2) next to the target spinning unit (2) and until when the first communication section (60) and the second

communication section (30) start communication.

3. The spinning machine according to claim 1 or claim 2, **characterized in that** the cleaning section (35, 37, 38, 81) is adapted to perform the cleaning of at least one of the first communication section (60) and the second communication section (30) immediately before the first communication section (60) and the second communication section (30) start communication at the target spinning unit (2).
4. The spinning machine according to any one of claim 1 through claim 3, **characterized in that** the cleaning section (35, 37, 38, 81) is adapted to stop cleaning of the first communication section (60) and the second communication section (30) before the communication section (60) and the second communication section (30) start communication at the target spinning unit (2).
5. The spinning machine according to any one of claim 1 through claim 3, **characterized in that** the service vehicle (3) includes at least a portion of the cleaning section (35, 37, 38).
6. The spinning machine according to any one of claim 1 through claim 5, **characterized in that** the cleaning section (38) is adapted to determine that the service vehicle (3) passed one spinning unit (2) when a reference portion (S) of the service vehicle (3) passed a reference portion (SD) of such a spinning unit (2), and to clean at least one of the first communication section (60) and the second communication section (30) in accordance with a determination result.
7. The spinning machine according to any one of claim 1 through claim 6, **characterized in that** the cleaning section includes:
 - a blow nozzle (35) adapted to blow air to at least one of the first communication section (60) and the second communication section (30);
 - an air supplying section (81) adapted to supply the air to the blow nozzle (35);
 - a switching section (37) adapted to switch between supplying of the air and shutting off of the supplying of the air to the blow nozzle (35) from the air supplying section (81); and
 - a control section (38) adapted to control switching of the switching section (37).
8. The spinning machine according to any one of claim 1 through claim 7, **characterized in that** each of the spinning units (2) includes a waxing device (14) adapted to apply wax to the yarn (10) supplied from the yarn supplying section (7, 9), and the cleaning section (35, 37, 38, 81) further cleans the waxing device (14) of the target spinning unit (2)

before the service vehicle (3) performs service to the target spinning unit (2).

9. The spinning machine according to claim 8, **characterized in that** the blow nozzle (35) includes:

a first nozzle (35a) adapted to blow the air to at least one of the first communication section (60) and the second communication section (30), and
a second nozzle (35b) adapted to blow the air to the waxing device (14).

10. The spinning machine according to any one of claim 1 through claim 9, **characterized by** a frame (6) adapted to form a travelling space of the service vehicle (3) below the yarn supplying section (7, 9) in a machine height direction.

11. The spinning machine according to any one of claim 1 through claim 10, **characterized in that** the service vehicle (3) is a yarn joining vehicle adapted to perform a yarn joining operation of the yarn (10) supplied from the yarn supplying section (7, 9) and the yarn from the package (45) when the yarn (10) is disconnected, and
the cleaning section (35, 37, 38, 81) is adapted to clean at least one of the first communication section (60) and the second communication section (30) during the yarn joining operation.

12. The spinning machine according to any one of claim 1 through claim 11, **characterized in that** the yarn supplying section includes:

a draft device (7) adapted to draft a fiber bundle (8); and
a pneumatic spinning device (9) adapted to twist the fiber bundle (8) using a whirling airflow and to produce the yarn (10).

13. The spinning machine according to claim 12, wherein the service vehicle (3) includes:

a first catching and guiding section (44) adapted to catch and guide the yarn (10) from the pneumatic spinning device (9) when the yarn (10) is disconnected;
a second catching and guiding section (46) adapted to catch and guide the yarn (10) from the package (45) when the yarn (10) is disconnected; and
a yarn joining device (43) adapted to join the yarn (10) guided by the first catching and guiding section (44) and the yarn (10) guided by the second catching and guiding section (46),
characterized in that the cleaning section (35, 37, 38, 81) is adapted to complete the cleaning

before the first catching and guiding section (44) starts guiding the yarn (10) to the yarn joining device (43).

14. A spinning machine comprising a plurality of spinning units (2) and a service vehicle (3) adapted to travel among the spinning units (2), each spinning unit (2) including a yarn supplying section (7, 9) adapted to supply a yarn (10) and a winding section (13) adapted to wind the yarn (10) into a package (45), the spinning machine comprising:

a first communication section (60) provided for each of the spinning units (2);
a second communication section (30) provided for the service vehicle (3) and adapted to perform non-contact communication with the first communication section (30); **characterized by** a cleaning section (35, 37, 38, 81) adapted to clean at least one of the first communication section (60) and the second communication section (30) in a range between a yarn path of one spinning unit (2) and a yarn path of a spinning unit (2) arranged next to such a spinning unit (2).

FIG. 1

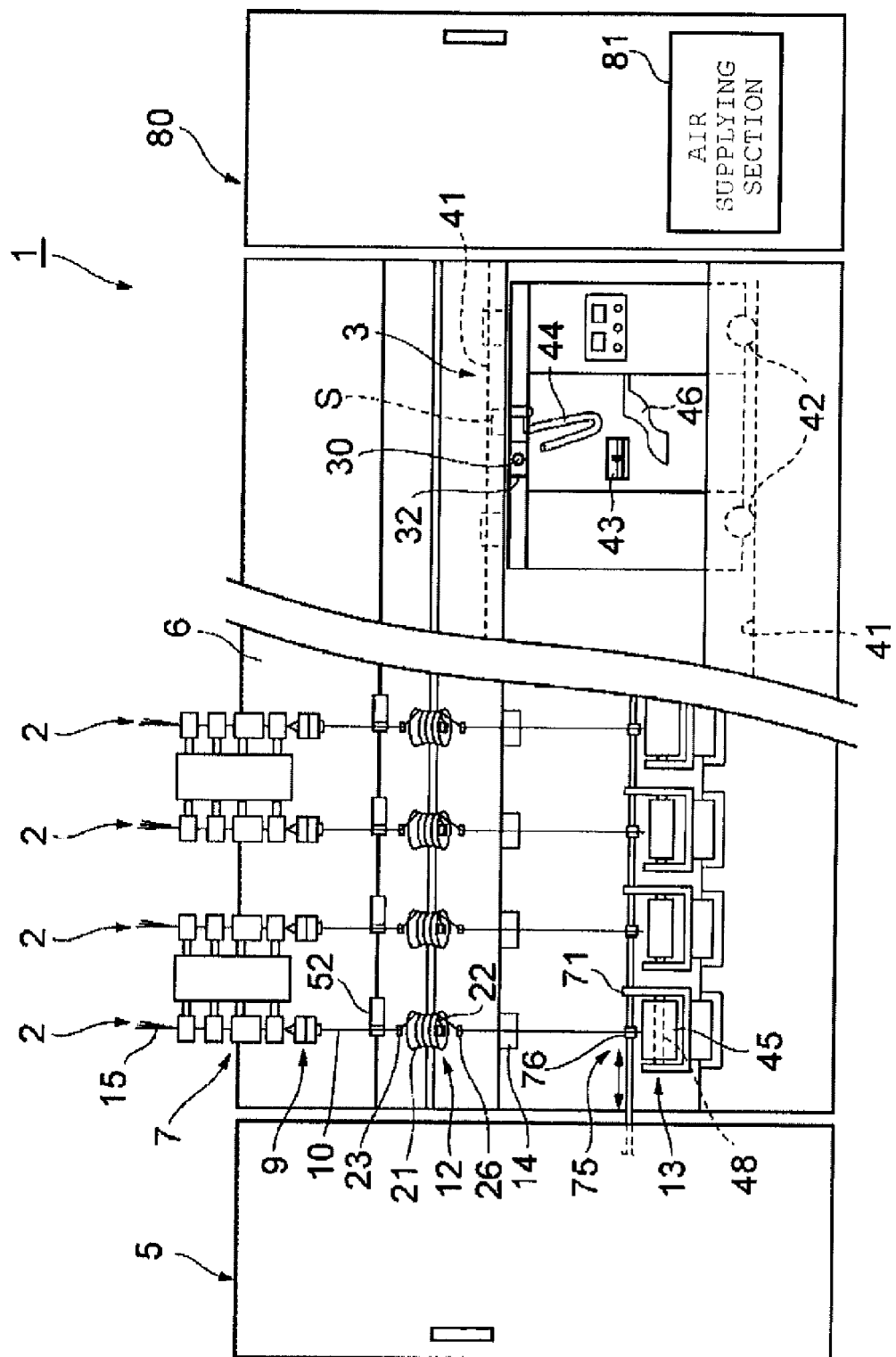


FIG. 2

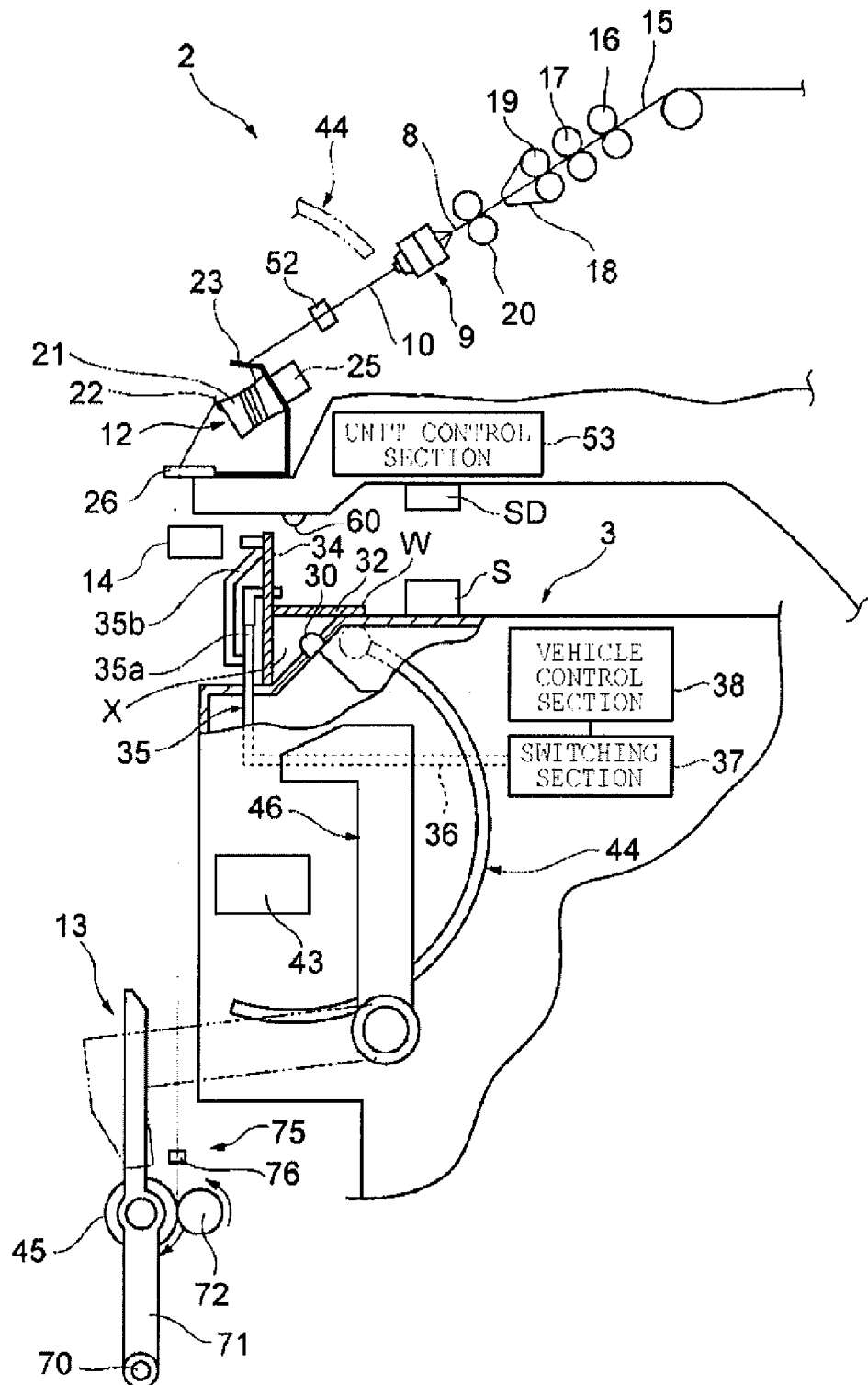
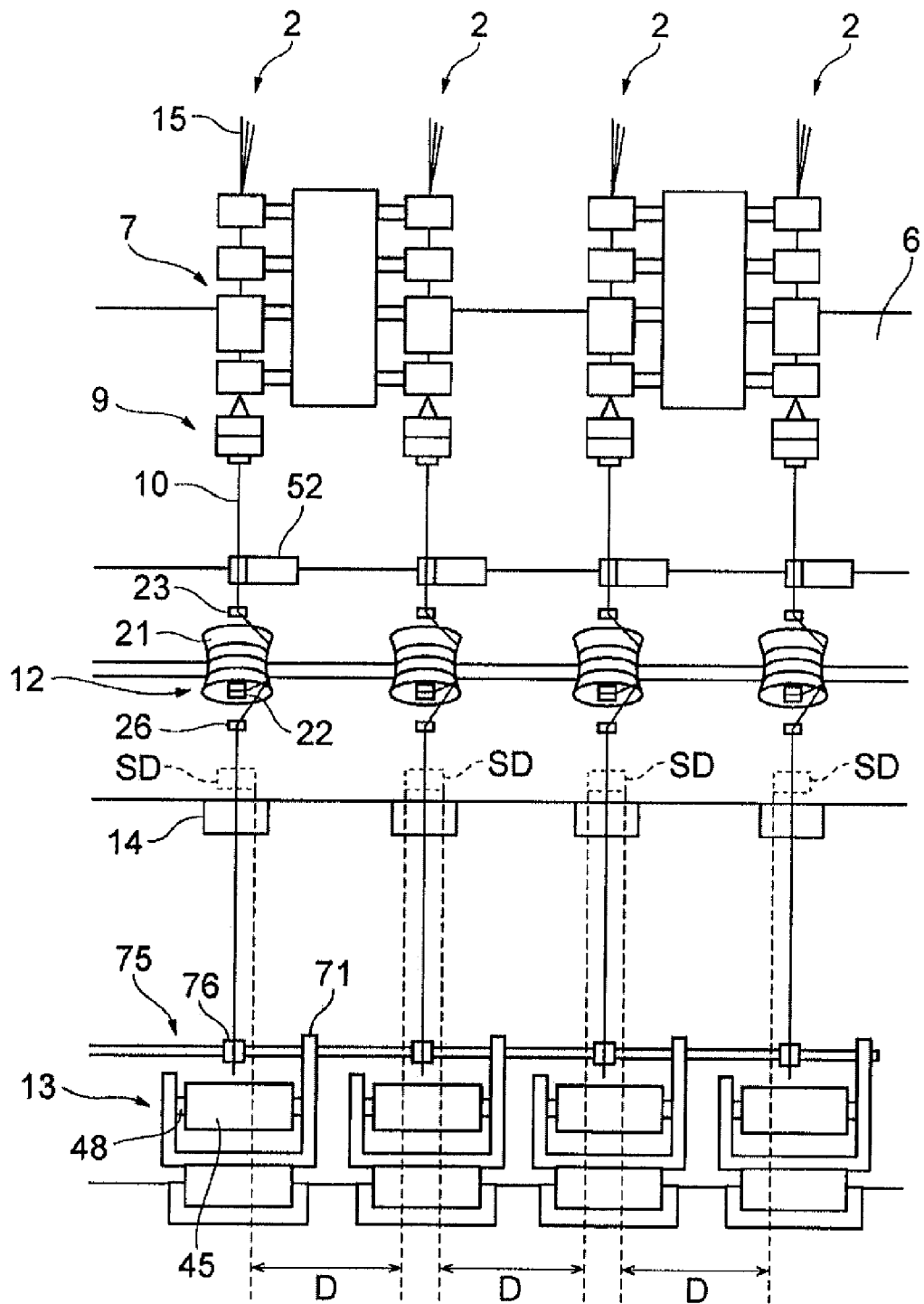


FIG. 3





EUROPEAN SEARCH REPORT

Application Number
EP 13 16 9514

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	DE 198 58 986 A1 (SCHLAFHORST & CO W [DE]) 29 June 2000 (2000-06-29) * column 3, line 48 - line 55 * -----	1,14	
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			B65H D01H G08C
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 October 2013	Examiner Pollet, Didier
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 13 16 9514

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The members are as contained in the European Patent Office EDP file on
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04-10-2013

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REFERENCES CITED IN THE DESCRIPTION

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