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

(11) EP 2 657 382 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
30.10.2013 Bulletin 2013/44

(51) Int Cl.:
D01H 13/14 *(2006.01)*

(21) Application number: **13158743.8**

(22) Date of filing: **12.03.2013**

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

(30) Priority: **27.04.2012 JP 2012103648**

(71) Applicant: **Murata Machinery, Ltd.**
Minami-ku
Kyoto-shi
Kyoto 601-8326 (JP)

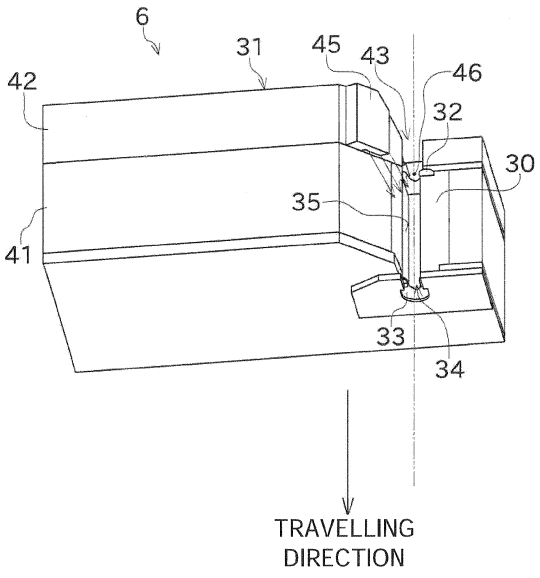
(72) Inventors:
- **Fukuda, Isao**
  Kyoto, 612-8686 (JP)
- **Nakade, Kazuhiko**
  Kyoto, 612-8686 (JP)

(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(54) Yarn monitoring device and yarn winding machine including the same

(57) A yarn monitoring device (6) includes a holder (30), a detecting section, and a blowing section (45). The holder (30) is provided with a first yarn passage (34) for enabling passage of a spun yarn travelling along a predetermined yarn path. The detecting section is adapted to detect at least at a portion of a side wall surface (35) of the first yarn passage (34), status of the spun yarn. The blowing section (45) is adapted to blow compressed air in a predetermined blowing direction to the side wall surface (35) of the first yarn passage (34), and configured such that when viewed in a direction orthogonal to the yarn path and parallel to the side wall surface (35), the blowing direction is set diagonal to the side wall surface (35).

FIG. 3



EP 2 657 382 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a configuration in which fluid is blown to remove yarn wastes attached to a travelling passage of a yarn in a yarn monitoring device adapted to monitor a traveling yarn.

2. Description of the Related Art

[0002] There is known a yarn winding machine, such as a spinning machine or an automatic winder, adapted to wind a yarn around a bobbin. The yarn winding machine of such kind includes a yarn monitoring device (a yarn clearer) adapted to monitor status of a travelling yarn in real time, and a yarn defect(a yarn portion having abnormal quality) is detected by the yarn monitoring device.

[0003] In the yarn winding machine, when the yarn is wound, small fiber wastes, yarn fragments and/or other wastes, and the like (hereinafter collectively referred to as "yarn wastes") may fly and attach to each portion. For example, when a large volume of yarn wastes attaches to the yarn monitoring device, the status of the yarn may not be accurately monitored by the yarn monitoring device. Japanese Unexamined Patent Publication No. 2005-232650 discloses a spinning machine including a cleaning nozzle adapted to blow and remove the yarn wastes and the like accumulated in a detecting head of the yarn clearer. The cleaning nozzle of which one end is arranged facing an upper side of the yarn clearer, blows compressed air around the detecting head.

SUMMARY OF THE INVENTION

[0004] Since the compressed air needs to be generated by a compressor, consuming a large amount of the compressed air becomes a cause of cost increase. Therefore, the cleaning nozzle is desired to be capable of removing the yarn wastes more reliably with less amount of flow. Thus, consideration may be made to enhance efficiency and reliability of the removal of the yarn wastes by devising an arrangement or a shape of the cleaning nozzle.

[0005] However, Japanese Unexamined Patent Publication No. 2005- 232650 merely discloses "a cleaning nozzle is arranged facing an upper side of the yarn clearer", and does not disclose a detailed description regarding an arrangement or a shape of such cleaning nozzle.

[0006] An object of the present invention is to provide a configuration capable of efficiently and reliably removing attached yarn wastes in a yarn monitoring device.

[0007] According to an aspect of the present invention, a yarn monitoring device includes a yarn passage defining member, a detecting section, and a blowing section. The yarn passage defining member includes a wall surface defining a yarn passage for enabling passage of a yarn travelling along a yarn path. The detecting section is adapted to detect at least at a portion of the wall surface of the yarn passage, status of the yarn. The blowing section is adapted to blow fluid in a blowing direction towards at least a portion of the wall surface. When viewed in a direction orthogonal to the yarn path and parallel to the wall surface, the blowing direction is set diagonal with respect to the wall surface. The fluid flows along the wall surface.

[0008] By diagonally blowing the fluid to the wall surface, the fluid that hits the wall surface flows along the wall surface. Thus, since the fluid can be applied to a wide area on the wall surface, yarn wastes attached to the wall surface can be efficiently removed with a small amount of flow.

[0009] In the yarn monitoring device, when viewed in a direction parallel to the yarn path, the blowing direction is preferably set diagonal with respect to the wall surface.

[0010] By blowing the fluid diagonally in such a manner even when viewed from another direction, the yarn wastes attached to the wall can be removed in wider area.

[0011] In the yarn monitoring device, the yarn passage is formed as a groove along the yarn path, and the blowing section preferably blows the fluid towards an interior of the yarn passage.

[0012] By blowing the fluid diagonally towards the interior of the groove-like yarn passage, a spiral flow is generated in the yarn passage. The yarn wastes attached to the wall surface thus can be more reliably removed with less amount of flow.

[0013] In the yarn monitoring device, the blowing section preferably blows the fluid from a slit-like blowing mouth.

[0014] By blowing the fluid from the slit, the yarn wastes can be removed in a wide area since the belt-like fluid can be applied to the wall surface.

[0015] In the yarn monitoring device, the blowing section preferably blows the fluid from upstream toward downstream in a travelling direction of the yarn.

[0016] If the fluid is blown from downstream to the wall surface, the travelling yarn could bring back the yarn wastes that should have been blown away towards upstream by the fluid. Since the fluid is blown from upstream to the wall surface, the yarn wastes are blown away to downstream, and the yarn wastes are not brought back by the yarn. The yarn wastes thus can be efficiently removed.

[0017] The yarn monitoring device includes a first block having the yarn passage defining member, and a second block having the blowing section. The first block and the second block are arranged next to each other in a direction parallel to the yarn path. A supply path of the fluid blown from the blowing section is provided in the second block.

[0018] Since the fluid supply path is not required to be provided in the first block and the yarn passage defining

member, the first block and the yarn passage defining member can be formed into a simple shape.

[0019] The yarn monitoring device preferably includes a cutter adapted to cut the yarn, and a cutter blowing section adapted to blow the fluid to the cutter in the second block.

[0020] By arranging a dedicated blowing section for the cutter, the fluid can be blown to the cutter with pinpoint accuracy. Yarn fragments and the like caught in the cutter thus can be reliably removed. Since the cutter or the like is arranged in the second block, the shape of the first block can be simplified.

[0021] In the yarn monitoring device, the detecting section includes a light emitting section adapted to emit light to the yarn, and a light receiving section arranged facing the light emitting section with the yarn path therebetween and adapted to receive the light emitted by the light emitting section. The blowing direction of the blowing section is set diagonal with respect to the wall surface where the light receiving section is arranged.

[0022] According to another aspect of the present invention, a yarn winding machine includes a winding section adapted to wind a yarn, and the yarn monitoring device adapted to monitor the yarn to be wound by the yarn winding section.

[0023] The yarn winding machine reliably enables the removal of the yarn wastes attached to the yarn passage of the yarn monitoring device with a small amount of the fluid flow. Therefore, the accuracy of the yarn monitoring by the yarn monitoring device can be maintained at low cost, and the quality of the wound yarn can be enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

FIG. 1 is a front view illustrating an overall structure of a spinning machine according to an embodiment of the present invention.

FIG. 2 is a side view of a spinning unit.

FIG. 3 is an exterior perspective view of a yarn monitoring device.

FIG. 4A and FIG. 4B are schematic cross sectional views of a holder.

FIG. 5 is a front view of the yarn monitoring device.

FIG. 6 is a planar cross sectional view of a first block.

FIG. 7 is a planar cross sectional view of a second block.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0025] Next, a spinning machine according to an embodiment of the present invention will be described with reference to the drawings. A spinning machine 1 as a yarn winding machine illustrated in FIG. 1 includes a plurality of spinning units 2 arranged next to each other, and a yarn joining cart 3.

[0026] As illustrated in FIG. 2, each spinning unit 2 includes a draft device 4, a spinning device 5, a yarn monitoring device 6, a yarn accumulating device 7, and a winding section 8 in this order from upstream towards downstream. "Upstream" and "downstream" in the present specification respectively indicate upstream and downstream in a travelling direction of a fiber bundle and a spun yarn at the time of spinning.

[0027] The draft device 4 stretches a sliver (material of a fiber bundle) 9 into a fiber bundle 10. The draft device 4 includes a plurality of draft rollers 11, 12, 13, and 14, and opposing rollers arranged facing each draft roller. The plurality of draft rollers 11, 12, 13, and 14 are respectively rotated at a predetermined rotation speed. By transporting the sliver 9 supplied from a sliver case that is not illustrated by holding between the rotating draft rollers 11, 12, 13, and 14 and the opposing rollers facing thereto, the draft device 4 stretches (drafts) the sliver 9 into the fiber bundle 10. The fiber bundle 10 drafted in the draft device 4 is supplied to the spinning device 5.

[0028] The spinning device 5 generates the spun yarn 15 by adding twists to the fiber bundle 10. Although the configuration of the spinning device 5 is not limited in particular, the spinning device 5 according to the present embodiment is configured as a pneumatic spinning device. The pneumatic spinning device 5 adds the twists to the fiber bundle 10 by generating a whirling airflow in its interior and applying the whirling airflow to the fiber bundle 10.

[0029] The spun yarn 15 generated in the spinning device 5 passes through the yarn monitoring device 6. The yarn monitoring device 6 monitors status of the travelling spun yarn 15 and detects a yarn portion with abnormal quality in the spun yarn 15 (a yarn defect). The yarn monitoring device 6 includes a cutter 16 adapted to cut the spun yarn 15. The configuration of the yarn monitoring device 6 will be described in detail later.

[0030] The spun yarn that has passed through the yarn monitoring device 6 is wound around a bobbin 17 by the winding section 8. The winding section 8 includes a cradle arm 19, a winding drum 20, and a traverse device 21.

[0031] The cradle arm 19 rotatably supports the bobbin 17 around which the spun yarn 15 is wound. The winding drum 20 rotates the bobbin 17 by being rotated in contact with an outer peripheral surface of the bobbin 17. The traverse device 21 includes a traverse guide 22 adapted to be driven from side to side (in a direction of a winding width of the bobbin 17) while being engaged with the spun yarn 15. The spun yarn 15 to be wound around the bobbin 17 is traversed by the traverse device 21.

[0032] By the spinning unit 2 configured as described above, the spun yarn 15 can be generated from the sliver 9 and wound around the bobbin 17. The bobbin 17 around which the spun yarn 15 is wound is referred as to a "package".

[0033] In the spinning machine 1 according to the present embodiment, the yarn accumulating device 7 is arranged between the yarn monitoring device 6 and the

winding section 8. The yarn accumulating device 7, as illustrated in FIG. 2, includes a yarn accumulating roller 23, and an electric motor 25 adapted to rotate the yarn accumulating roller 23.

[0034] The yarn accumulating roller 23 can temporarily accumulate a predetermined amount of the spun yarn 15 by winding the spun yarn 15 around an outer peripheral surface thereof. Since the yarn accumulating device 7 temporarily accumulates the spun yarn 15 in such a manner, the yarn accumulating device 7 functions as a kind of a buffer. Thus, a fault (a slackening of the spun yarn 15, for example) where a spinning speed in the spinning device 5 and a winding speed in the winding section 8 do not correspond to each other for some reason can be resolved.

[0035] Each spinning unit 2 includes a unit control section 26. The unit control section 26 is adapted to appropriately control each configuration provided in the spinning unit 2.

[0036] The yarn joining cart 3, as illustrated in FIG.1 and FIG.2, includes a yarn joining device 27 and suction devices (a suction pipe 28 and a suction mouth 29).

[0037] The yarn joining device 27 is a device adapted to join yarn ends (yarn joining). Although the configuration of the yarn joining device 27 is not limited in particular, an air splicer, for example, that twists the yarn ends together by a whirling airflow may be employed. The suction pipe 28 sucks and catches a yarn end fed from the spinning device 5, and guides the yarn end to the yarn joining device 27. The suction mouth 29 sucks and catches a yarn end from a package 18 supported by the winding section 8, and guides the yarn end to the yarn joining device 27.

[0038] Next, an operation of when the yarn defect is detected by the yarn monitoring device 6 will be described briefly.

[0039] The yarn monitoring device 6 sends a yarn defect detection signal to the unit control section 26 when detecting the yarn defect (an abnormal portion in the spun yarn 15). The unit control section 26 immediately activates the cutter 16 to cut the spun yarn 15 when receiving the yarn defect detection signal. The spun yarn 15 that is downstream of the cut portion is once wound into the package 18. In this case, the spun yarn 15 wound into the package 18 includes a portion of the yarn defect detected by the yarn monitoring device 6. Furthermore, the unit control section 26 stops the winding in the winding section 8. The unit control section 26 then sends a control signal to the yarn joining cart 3, and controls the yarn joining cart 3 to travel to a front of the spinning unit 2 where the yarn defect has been detected.

[0040] After stopping at the front of the spinning unit 2, the yarn joining cart 3 sucks and catches a yarn end fed from the spinning device 5, and guides the yarn end to the yarn joining device 27 by the suction pipe 28. The spun yarn 15 is then guided to the outer peripheral surface of the yarn accumulating roller 23 by a hooking mechanism that is not illustrated, and accumulated again. A slackening of the spun yarn 15 that occurs during a yarn joining operation is thus resolved by the yarn accumulating device 7. Almost simultaneously, the yarn joining cart 3 sucks and catches the yarn end wound into the package 18, and guides the yarn end to the yarn joining device 27 by the suction mouth 29. In this case, the portion of the yarn defect wound into the package 18 is sucked and pulled out by the suction mouth 29. The portion of the yarn defect detected by the yarn monitoring device 6 is thus removed from the package 18.

[0041] The yarn joining device 27 joins the yarn ends together (yarn joining) that has been guided by the suction pipe 28 and the suction mouth 29. The spun yarn 15 that has been cut by the cutter 16 thus becomes connected again between the spinning device 5 and the winding section 8.

[0042] After a yarn joining operation in the yarn joining device 27 is completed, the unit control section 26 resumes winding of the spun yarn 15 by the winding section 8. By the operations described above, the yarn defect detected by the yarn monitoring device 6 can be removed, and the winding of the spun yarn 15 into the package 18 can be resumed.

[0043] Next, the configuration of the yarn monitoring device 6 will be described in detail.

[0044] As illustrated in FIG. 3, the yarn monitoring device 6 according to the present embodiment includes a holder (sensor holding member) 30, a housing 31, and yarn path guides 32 and 33.

[0045] The holder 30 is a member made of plastic, where a detecting section (such as sensor) for detecting the status of the spun yarn 15 is embedded in the interior thereof. The holder 30 is provided with a first yarn path 34 where the spun yarn 15 passes through. Therefore, the holder 30 may be referred to as a yarn passage defining member. The first yarn passage 34 provided in the holder 30 is formed as a groove along a travelling path (hereinafter referred as to a "yarn path") of the spun yarn 15.

[0046] An outline shape of an inner wall surface of the first yarn passage 34 is formed as a substantially U-shape when cut in a plane orthogonal to the yarn path. That is, when the first yarn passage 34 is viewed in a direction parallel to the yarn path, one end portion of the first yarn passage 34 is formed to be opened, and the other end portion is formed to be closed (see FIG. 4B). In a following description regarding the yarn monitoring device 6, when viewed in a direction parallel to the yarn path, a front-back direction of the yarn monitoring device 6 is defined by a direction in which the opened side of the first yarn passage 34 faces (an upper side of FIG.4B) as a "front", and by an opposite direction thereto as a "back". That is, the opened side of the first yarn passage 34 is a front side of the yarn monitoring device 6.

[0047] The first yarn passage 34 includes a pair of side wall surfaces 35 and 35 arranged in parallel to each other with the yarn path therebetween. The side wall surfaces 35 and 35 are arranged parallel to the front-back direction

of the yarn monitoring device 6 (a vertical direction of FIG. 4B) and the yarn path. The spun yarn 15 passing through the first yarn passage 34 travels between the side wall surfaces 35 and 35.

[0048] Next, a configuration of the detecting section will be described with reference to FIG. 4A and FIG. 4B. The yarn monitoring device 6 according to the present embodiment is configured as an optical yarn monitoring device adapted to detect the status of the spun yarn 15 by irradiating light to the spun yarn 15. Specifically, the detecting section includes a light emitting element (a light emitting section) 37 and a light receiving element (a light receiving section) 38. An appropriate light emitting element such as Light Emitting Diode (LED), for example, may be adopted as the light emitting element 37. The light receiving element 38 configured as a photodiode converts an intensity of received light into an electric signal and outputs the electric signal.

[0049] The light receiving element 38 is arranged such that a light receiving surface thereof constitutes a part of the side wall surface 35 of the first yarn passage 34. A transparent plate 39 made of resin is provided as a part of the side wall surface 35 opposite to the light receiving element 38. The light emitting element 37 is arranged opposite to the first yarn passage 34 with the transparent plate 39 therebetween (inside the holder 30). The light emitting element 37 irradiates light to the first yarn passage 34 via the transparent plate 39. The light emitting element 37 and the light receiving element 38 are arranged facing each other with the yarn path therebetween.

[0050] In the configuration described above, light from the light emitting element 37 is received by the light receiving element 38 with a portion of the light being blocked by the spun yarn 15. Therefore, the intensity of the light received by the light receiving element 38 changes according to a thickness of the spun yarn 15. The thickness of the spun yarn 15 thus can be detected based on the intensity of the light received by the light receiving element 38.

[0051] As described above, from a portion of the side wall surface 35 of the first yarn passage 34, the detecting section of the yarn monitoring device 6 monitors the status of the spun yarn 15 (specifically, the thickness of the spun yarn 15) passing between the side wall surfaces 35.

[0052] Next, the housing 31 of the yarn monitoring device 6 will be described. The housing 31 includes a first block 41 and a second block 42 arranged next to each other in a direction parallel to the yarn path. The first block 41 and the second block 42 are made of plastic, respectively. The first block 41 and the second block 42 are formed as a different body and separable.

[0053] As illustrated in FIG. 6, the holder 30 is mounted to the first block 41. The first block 41 accommodates a circuit substrate 44 adapted to control the light emitting element 37 and the light receiving element 38 of the detecting section.

[0054] The second block 42 is arranged upstream of the first block 41. As illustrated in FIG. 3 and FIG. 7, the second block 42 is provided with a second yarn passage 43 where the spun yarn 15 passes through. The second yarn passage 43 is formed as a groove along the yarn path, and its cross-sectional shape is substantially U-shaped. The second yarn passage 43 is formed so as to communicate with the first yarn passage 34.

[0055] The cutter 16 is arranged in the second block 42. The cutter 16 can cut the spun yarn 15 travelling in the second yarn passage 43. A cutter drive mechanism (not illustrated) adapted to drive the cutter 16 to cut the spun yarn 15 is arranged in the second block 42.

[0056] The yarn path guides 32 and 33 are members for regulating the yarn path of the spun yarn 15 and configured by material having abrasion resistance (ceramic in the present embodiment). Each of the yarn path guides 32 and 33 are separately arranged upstream and downstream of the holder 30. The spun yarn 15 travels while making contact with the yarn path guides 32 and 33. Since a travelling position of the spun yarn 15 with respect to the holder 30 is stabilized, a status of the spun yarn 15 can be stably monitored in the detecting section.

[0057] The yarn monitoring device 6 according to the present embodiment includes a blowing section 45 adapted to blow a fluid (specifically, compressed air) to the side wall surface 35 of the first yarn passage 34. The yarn wastes and the like attached to the side wall surface 35 thus can be blown away. The compressed air may be blown periodically, or non-periodically under appropriate timing. Since the side wall surface 35 (especially the transparent plate 39 and the light receiving surface of the light receiving element 38) can be kept clean in such a manner, the yarn monitoring device 6 can accurately monitor the status of the spun yarn 15.

[0058] Next, a configuration of the blowing section 45 of the yarn monitoring device 6 according to the present embodiment will be described in detail.

[0059] The object of the blowing section 45 is to blow away the yarn wastes attached to the light receiving surface of the light receiving element 38 and/or the transparent plate 39 by blowing the compressed air. A configuration may be considered in which the blowing section 45 is provided in proximity to the transparent plate 39 and the light receiving element 38 to blow the air with pinpoint accuracy to the transparent plate 39 and the light receiving element 38.

[0060] However, to blow the air with pinpoint accuracy to the transparent plate 39 and the light receiving element 38, the blowing section 45 is required to be provided in the holder 30, for example. In this case, an air supply path to the blowing section 45 is required to be provided in the holder 30, which makes the shape of the holder 30 complicated. Although the blowing section 45 may be considered to be provided in the first block 41 of the housing 31, in this case, the air supply path is required to be provided in the first block 41. However, since the circuit substrate 44 and the like are arranged in the first block 41, there is no extra space and the air path is difficult to

be formed. Furthermore, if the air path is provided in the first block 41, a shape of the first block 41 becomes complicated.

[0061] In case of a configuration in which the compressed air is blown with pinpoint accuracy, the flow of the air can merely be applied to a narrow area of the transparent plate 39 and the light receiving element 38. Therefore, to entirely clean the transparent plate 39 and the light receiving surface of the light receiving element 38, a plurality of blowing sections is required to be provided. When the number of the blowing sections increases, a consumption of the compressed air increases and efficiency decreases.

[0062] Therefore, the blowing section 45 according to the present embodiment is adapted to diagonally blow the compressed air to the side wall surface 35 of the first yarn passage 34. By diagonally blowing the compressed air to the side wall surface 35, the compressed air can flow along the side wall surface 35. By making the air to flow along the side wall surface 35, the flow of the air can be applied to a wide area of the side wall surface 35. Thus, since the compressed air can be applied to the transparent plate 39 and the light receiving element 38 entirely, the yarn wastes attached to the transparent plate 39 and/or the light receiving element 38 can be efficiently blown away with a small amount of airflow.

[0063] A blowing direction of the air from the blowing section 45 is illustrated by thin line arrows in FIG. 3 and FIG. 5 to FIG. 7. As illustrated in FIG. 5, when viewed in a direction orthogonal to the yarn path and parallel to the side wall surface 35 of the first yarn passage 34, the blowing direction of the compressed air from the blowing section 45 is set diagonal with respect to the side wall surface 35. Therefore, the blowing direction of the air from the blowing section 45 has a vector component in a direction parallel to the yarn path (a longitudinal direction of the first yarn passage 34, a vertical direction in FIG. 5). The air blown in this direction to the side wall surface 35 swiftly flows towards the longitudinal direction of the first yarn passage 34 along the side wall surface 35. Thus, the side wall surface 35 of the first yarn passage 34 can be entirely cleaned.

[0064] As illustrated in FIG.5, the blowing section 45 is adapted to blow the air from upstream towards downstream in the travelling direction to the side wall surface 35 of the first yarn passage 34. Thus, the yarn wastes attached to the side wall surface 35 can be blown away towards downstream. Accordingly, the blown yarn wastes do not return to the yarn monitoring device 6 by being accompanied by the travelling spun yarn 15.

[0065] The blowing direction of the compressed air from the blowing section 45 according to the present embodiment is set diagonal with respect to the side wall surface 35 even when viewed in a direction parallel to the yarn path (see FIG. 6). That is, the blowing direction of the air from the blowing section 45 has a vector component in the front-back direction of the yarn monitoring device 6 (a depth direction of the first yarn passage 34, a vertical direction in FIG. 6). The air blown in this direction to the side wall surface 35 also flows in the depth direction of the first yarn passage 34 along the side wall surface 35. Thus, the blown air from the blowing section 45 can be applied to a wider area of the side wall surface 35.

[0066] As illustrated in FIG. 3 and FIG. 6, the blowing section 45 is arranged outside of the first yarn passage 34. More specifically, when viewed in a direction parallel to the yarn path, the blowing section 45 is arranged to the front of an opened end of the substantially U-shaped first yarn passage 34. Thus, the blowing section 45 blows the air towards an interior of the first yarn passage 34. By diagonally blowing the air towards the interior of the groove-like first yarn passage 34, the spiral flow of the air can be generated in the first yarn passage 34 (see FIG. 6).

[0067] The blowing section 45 according to the present embodiment is adapted to blow the compressed air to either of the pair of the side wall surfaces 35 and 35 facing to each other in the first yarn passage 34. Therefore, the compressed air from the blowing section 45 is not directly applied to the other side wall surface 35. However, as described above, by producing the spiral airflow in the first yarn passage 34, the airflow can also be applied to the side wall surface 35 where the compressed air is not directly blown from the blowing section 45. The airflow thus can be applied to the pair of both the side wall surfaces 35 and 35. Therefore, the blown air from one blowing section 45 can clean both the transparent plate 39 and the light receiving surface of the light receiving element 38.

[0068] In the present embodiment, the blowing section 45 is adapted to blow the compressed air from a slit-like blowing mouth. Since belt-like compressed air having a width thus can be blown to the side wall surface 35, the air can be applied to the side wall surface 35 in a wider area.

[0069] As illustrated in FIG. 3, FIG. 5 and FIG. 7, the yarn monitoring device 6 according to the present embodiment includes a cutter blowing section 46 separately from the blowing section 45. The cutter blowing section 46 is provided inside the second yarn passage 43 and adapted to blow the compressed air to the cutter 16.

[0070] Yarn fragments and the like of the spun yarn 15 caught in the cutter 16 can be blown away by the cutter blowing section 46. Since the points of the cutter 16 where the yarn fragments and the like are caught are fixed, blowing the air to the cutter 16 with pinpoint accuracy is more efficient than blowing the air in a wide area. Therefore, the cutter blowing section 46 is configured as a round-hole-like nozzle. The air thus can be blown to the cutter 16 with pinpoint accuracy.

[0071] As illustrated in FIG. 7, when viewed in a direction parallel to the yarn path, the cutter blowing section 46 is provided in a closed-end portion of the U-shaped second yarn passage 43 (a back of the second yarn passage 43). The cutter blowing section 46 is adapted to

blow the compressed air towards an opened side (towards a front) of the second yarn passage 43. The yarn fragments and the like of the spun yarn 15 caught in the cutter 16 thus can be blown away towards an outside of the second yarn passage 43.

[0072] As described above, in the yarn monitoring device 6 according to the present embodiment, the belt-like air is blown from the slit-like mouth to the side wall surface 35 for applying the air to a wide area, while the air is blown with pinpoint accuracy from the round-hole-like nozzle to the cutter 16. Since methods to blow the compressed air vary according to an object, the yarn wastes and the like can be removed more efficiently. As a result, since an effect of a cleaning is efficiently achieved with a small amount of flow, the consumption of the compressed air can be decreased.

[0073] Next, a specific configuration of the blowing section 45 will be described.

[0074] As described above, the blowing section 45 is adapted to blow the air from upstream in the travelling direction of the spun yarn 15 in a direction diagonal to the side wall surface 35 of the first yarn passage 34 provided in the holder 30. Therefore, the blowing section 45 is sufficient to be arranged upstream of the holder 30 in the travelling direction, and the holder 30 and the blowing section 45 are not necessarily arranged at the same position in the travelling direction.

[0075] In the yarn monitoring device 6 according to the present embodiment, the blowing section 45 is provided not in the first block 41 having the holder 30, but in the second block 42 arranged upstream of the first block 41. Thus, since the blowing section 45 is not provided in the holder 30 and the first block 41, the holder 30 and the first block 41 can be simply configured.

[0076] As illustrated in FIG. 7 and the like, the second block 42 is connected to a compressed air supply hose 48 adapted to supply the compressed air to the yarn monitoring device 6. A supply path 49 adapted to supply the compressed air from the compressed air supply hose 48 to the blowing section 45 is provided in the second block 42. In the present embodiment, an air supply path 50 for the cutter blowing section 46 is also provided in the second block 42. Since the compressed air supply paths 49 and 50 are provided in the second block 42, an air supply path is not required to be provided in the holder 30 and the first block 41. Therefore, the shapes of the holder 30 and the first block 41 can be simply configured.

[0077] As described above, the yarn monitoring device 6 according to the present embodiment includes the holder 30, the detecting section, and the blowing section 45. The first yarn passage 34 for enabling passage of the spun yarn 15 travelling along the predetermined yarn path is provided in the holder 30. The detecting section is adapted to detect at least at a portion of the side wall surface 35 of the first yarn passage 34, the status of the spun yarn 15. The blowing section 45 is adapted to blow the compressed air in the predetermined blowing direction to the side wall surface 35 of the first yarn passage 34. When viewed in a direction orthogonal to the yarn path and parallel to the side wall surface 35, the blowing direction is set diagonal with respect to the side wall surface 35.

[0078] By diagonally blowing the compressed air to the side wall surface 35, the compressed air applied to the side wall surface 35 flows along the side wall surface 35. Thus, since the airflow can be applied to a wide area of the side wall surface 35, the yarn wastes attached to the side wall surface 35 can be removed efficiently with a small amount of flow.

[0079] In the yarn monitoring device 6 according to the present embodiment, when viewed in a direction parallel to the yarn path, the blowing direction is set diagonal with respect to the side wall surface 35.

[0080] By blowing the compressed air diagonally even when viewed from another direction, the yarn wastes on the side wall surface 35 can be removed in a wider area.

[0081] In the yarn monitoring device 6 according to the present embodiment, the first yarn passage 34 is formed as a groove along the yarn path, and the blowing section 45 blows the compressed air towards the interior of the first yarn passage 34.

[0082] By diagonally blowing the compressed air towards the interior of the groove-like first yarn passage 34, the spiral flow is generated in the first yarn passage 34. The yarn wastes on the side wall surface 35 thus can be reliably removed with less amount of flow.

[0083] In the yarn monitoring device 6 according to the present embodiment, the blowing section 45 blows the compressed air from the slit-like blowing mouth.

[0084] Since the belt-like airflow can be applied to the side wall surface 35 by blowing the compressed air from the slit, the yarn wastes can be removed in a wide area.

[0085] In the yarn monitoring device 6 according to the present embodiment, the blowing section 45 blows the compressed air from upstream towards downstream in the travelling direction of the spun yarn 15.

[0086] If the compressed air is blown from downstream to the side wall surface 35, the travelling spun yarn 15 could bring back the yarn wastes that should have been blown away towards upstream by the compressed air. Therefore, as described above, by blowing the compressed air from upstream to the side wall surface 35, the yarn wastes are blown away to downstream and not brought back by the spun yarn 15. The yarn wastes thus can be removed efficiently.

[0087] The yarn monitoring device 6 according to the present embodiment includes the first block 41 having the holder 30 and the second block 42 having the blowing section 45. The first block 41 and the second block 42 are arranged next to each other in the direction parallel to the yarn path. The compressed air supply path 49 for the blowing section 45 is provided in the second block 42.

[0088] Accordingly, since the compressed air supply path 49 is not required to be provided in the first block 41 and the holder 30, the first block 41 and the holder 30 can be formed into a simple shape.

[0089] The yarn monitoring device 6 according to the present embodiment includes the cutter 16 adapted to cut the spun yarn 15, and the cutter blowing section 46 adapted to blow the compressed air to the cutter 16 in the second block 42.

[0090] By arranging the cutter blowing section 46 separately from the blowing section 45 in such a manner, the fluid can be blown to the cutter 16 with pinpoint accuracy. The yarn fragments and the like of the spun yarn 15 caught in the cutter 16 thus can be reliably removed. Since the cutter 16 or the like is arranged in the second block 42, the shape of the first block 41 can be simplified.

[0091] The spinning machine 1 according to the present embodiment includes the winding section 8 adapted to wind the spun yarn 15 and the yarn monitoring device 6 adapted to monitor the spun yarn 15 to be wound by the winding section 8.

[0092] The spinning machine 1 reliably enables the removal of the yarn wastes attached to the first yarn passage 34 of the yarn monitoring device 6 with a small amount of the fluid flow. Therefore, the accuracy of the yarn monitoring by the yarn monitoring device 6 can be maintained at low cost, and the quality of the wound spun yarn 15 can be enhanced.

[0093] Although the preferred embodiment of the present invention is described above, the above configuration may be changed as below, for example.

[0094] The configuration of the present application may be applied not only to a spinning machine but to another kind of a yarn winding machine such as an automatic winder. An automatic winder is a device adapted to unwind a yarn of a yarn supplying bobbin and rewind the yarn around a winding bobbin while applying a predetermined tension to the yarn. The status of the yarn to be rewound can be accurately monitored by employing the yarn monitoring device according to the invention of the present application in the automatic winder.

[0095] In the description above, the yarn monitoring device is described as an optical yarn monitoring device having one light emitting element and one light receiving element, but, without limiting thereto, the yarn monitoring device may include a plurality of light emitting elements and/or a plurality of light receiving elements. In the yarn monitoring device according to the above-described embodiment, the thickness of the yarn is detected by monitoring the intensity of the light blocked by the yarn, but, without limiting thereto, whether or not a foreign substance is included in the yarn may be detected by monitoring, for example, intensity of reflected light from the yarn.

[0096] The detecting section may be adapted to detect the status of the yarn not only by an optical sensor but, for example, by a capacitance sensor. Even in this case, since the detecting accuracy is lowered when the yarn wastes are accumulated in the first yarn passage 34, there is an advantage to remove the yarn wastes by the above-described configuration.

[0097] In the embodiment described above, the abnormal portion of the yarn (the yarn defect) is detected by the yarn monitoring device 6, but the embodiment is not limited thereto. The yarn monitoring device may be configured to detect and monitor at least one kind of status of the travelling yarn such as a travelling speed of the yarn or a travelled length of the yarn.

[0098] The unit control section 26, instead of being arranged in each spinning unit 2, may be arranged in each of a plurality of the spinning units 2 so that one unit control section 26 controls a plurality of spinning units 2.

Claims

1. A yarn monitoring device comprising:

a yarn passage defining member (30) including a wall surface (35) adapted to define a yarn passage (34) for enabling passage of a yarn (15) travelling along a yarn path,
a detecting section (37, 38) adapted to detect at least at a portion of the wall surface (35), status of the yarn (15), and
a blowing section (45) adapted to blow fluid in a blowing direction towards at least a portion of the wall surface (35, 38, 39) the blowing section (45) being configured such that when viewed in a direction orthogonal to the yarn path and parallel to the wall surface (35, 38, 39) the blowing direction is set diagonal to the wall surface (35, 38, 39) and the fluid flows along the wall surface (35, 38, 39).

2. The yarn monitoring device according to claim 1, wherein when viewed in a direction parallel to the yarn path, the blowing direction is set diagonal with respect to the wall surface (35).

3. The yarn monitoring device according to claim 2, wherein the yarn passage (34) is formed as a groove along the yarn path, and the blowing section (45) is adapted to blow the fluid towards an interior of the yarn passage (34).

4. The yarn monitoring device according to any one of claim 1 through claim 3, wherein the blowing section (45) includes a slit-like opening from which the fluid is blown.

5. The yarn monitoring device according to any one of claim 1 through claim 4, wherein the blowing section (45) is adapted to blow the fluid from upstream towards downstream in a traveling direction of the yarn (15).

6. The yarn monitoring device according to any one of claim 1 through claim 5, further comprising:

a first block (41) including the yarn passage defining member (30), and
a second block (42) arranged next to the first block (41) in a direction parallel to the yarn path, the second block (42) including the blowing section (45) and a supply path (49) of the fluid blown from the blowing section (45).

7. The yarn monitoring device according to claim 6, wherein the second block (42) includes a cutter (16) adapted to cut the yarn (15), and a cutter blowing section (46) adapted to blow the fluid to the cutter (16).

8. The yarn monitoring device according to any one of claim 1 through claim 7, wherein the detecting section (37, 38) includes a light emitting section (37) adapted to emit light to the yarn (15), and a light receiving section (38) arranged facing the light emitting section (37) with the yarn path therebetween and adapted to receive the light emitted by the light emitting section (37) and
the blowing direction of the blowing section (45) is set diagonally with respect to the wall surface (35) where the light receiving section (38) is arranged.

9. A yarn winding machine comprising:

a winding section (8) adapted to wind a yarn (15), and
the yarn monitoring device (6) according to any one of claim 1 through claim 8, adapted to monitor the yarn (15) to be wound by the winding section (8).

FIG. 1

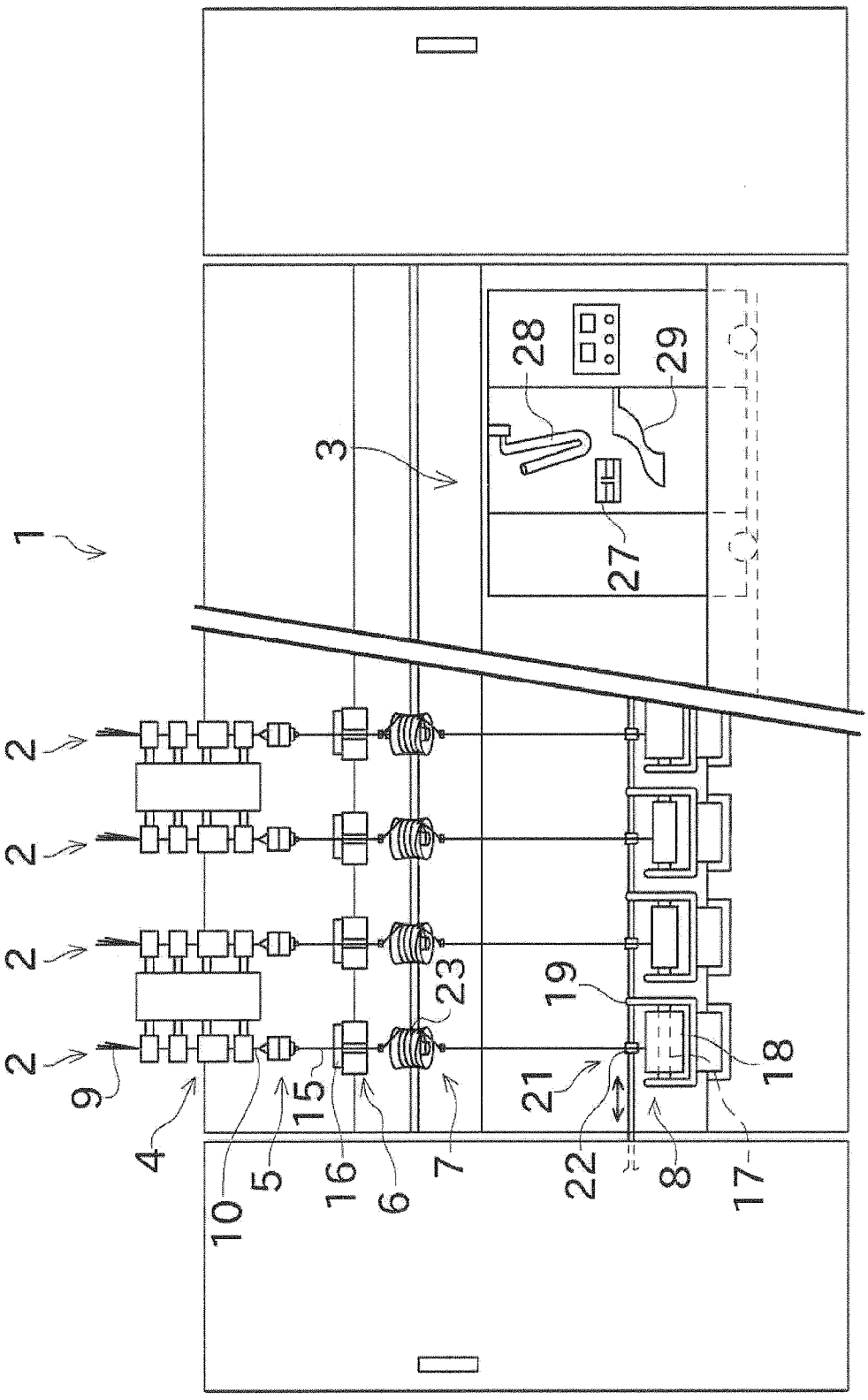


FIG. 2

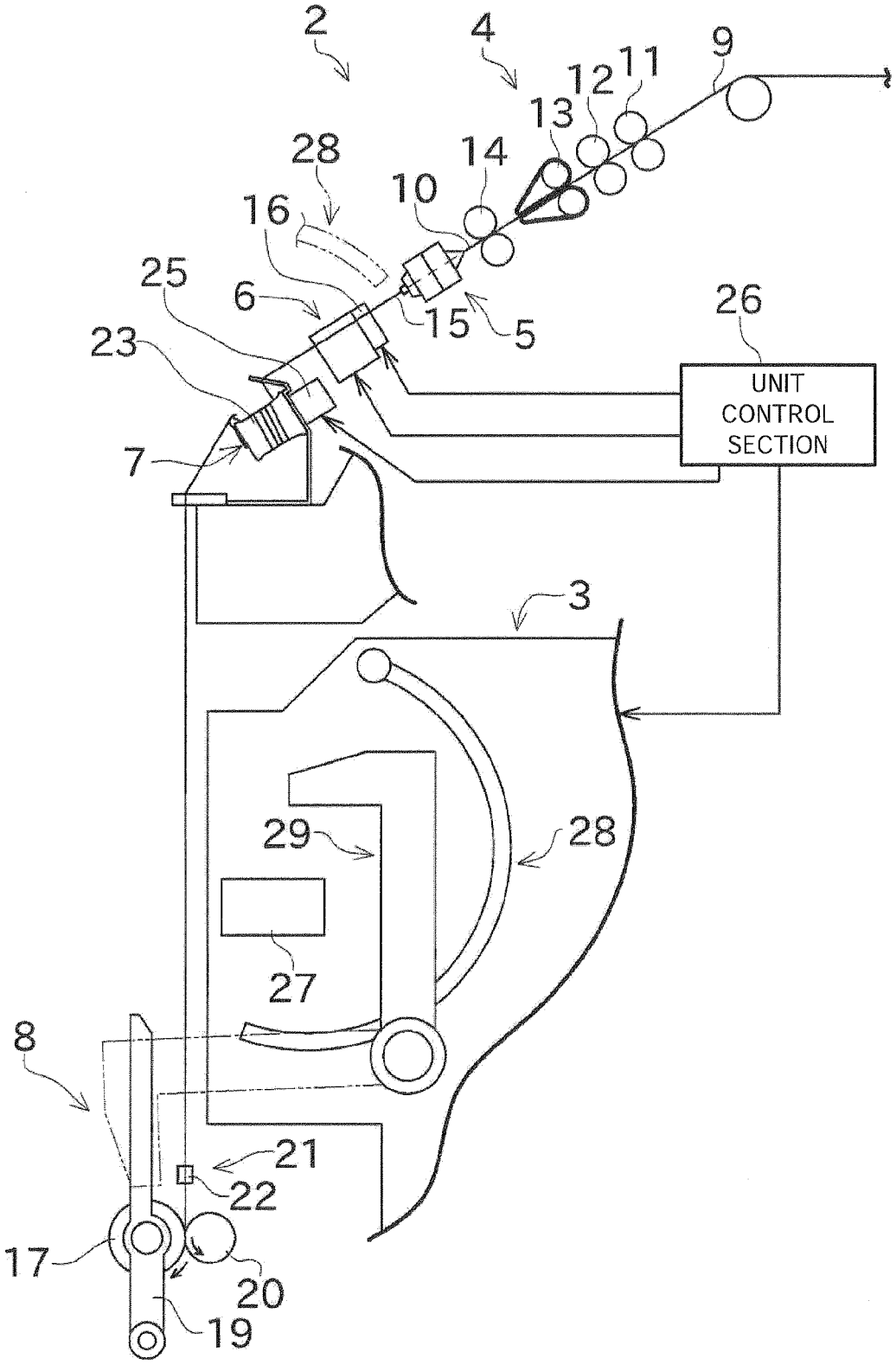

2
4
9
11
12
13
14
28
10
16
25
6
15
5
26
23
UNIT
CONTROL
SECTION
7
3
29
28
27
8
21
22
17
20
19

FIG. 3

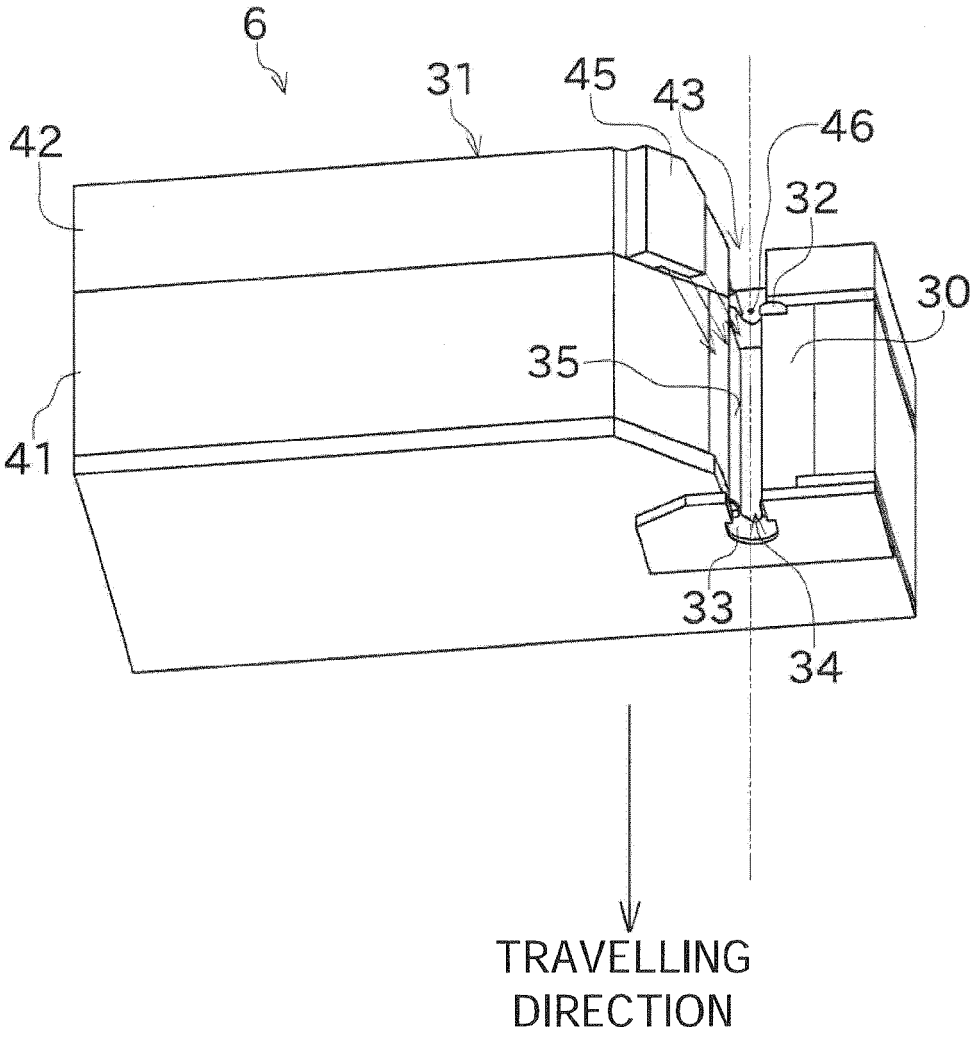


FIG. 4A

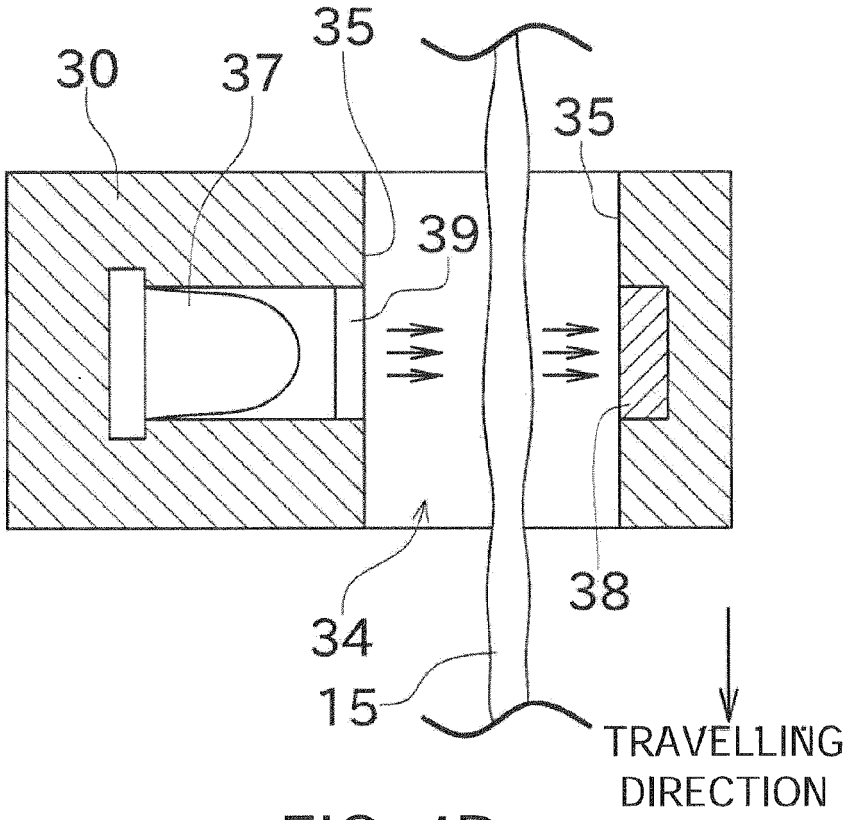

35
30
37
35
39
34
38
15
TRAVELLING
DIRECTION

FIG. 4B

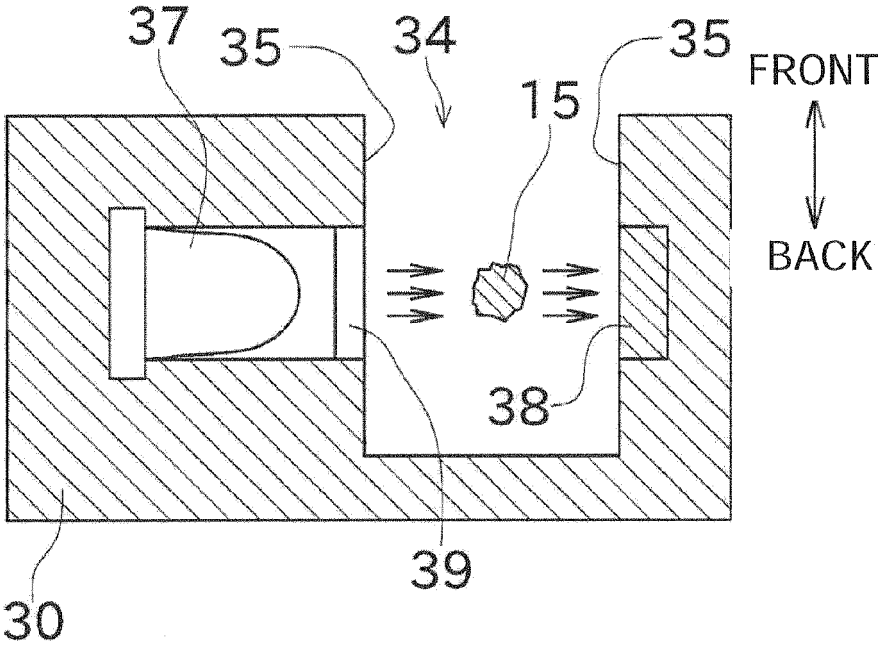

37
35
34
35
FRONT
15
BACK
38
39
30

FIG. 5

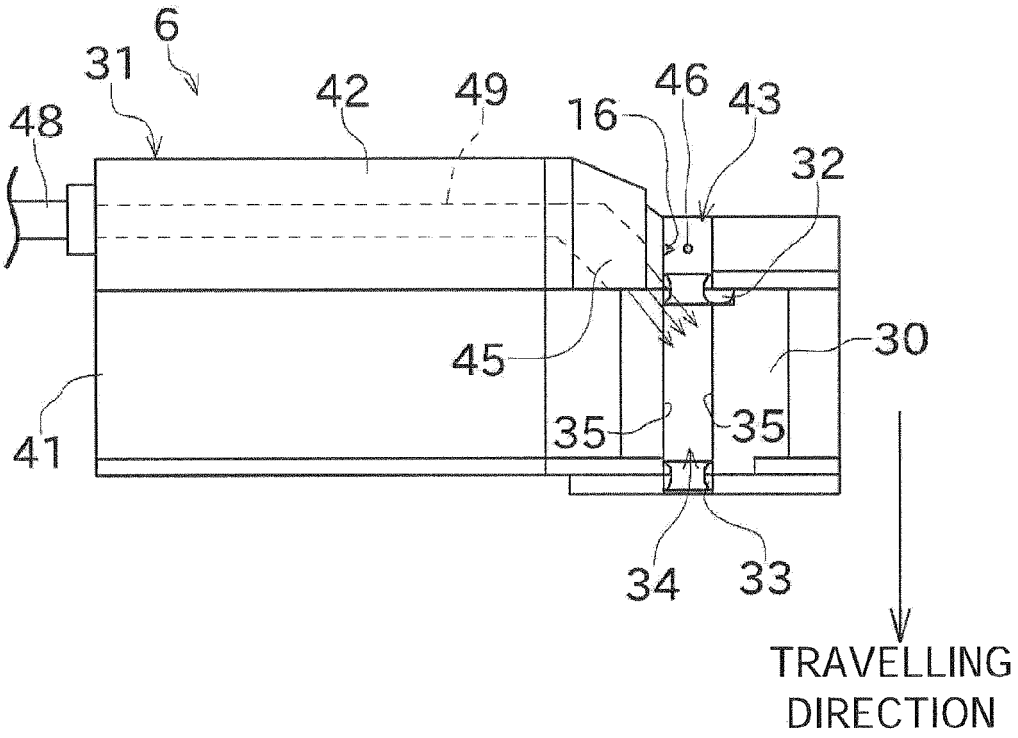

6
31
42
49
46
43
48
16
32
45
30
41
35
35
34
33
TRAVELLING
DIRECTION

FIG. 6

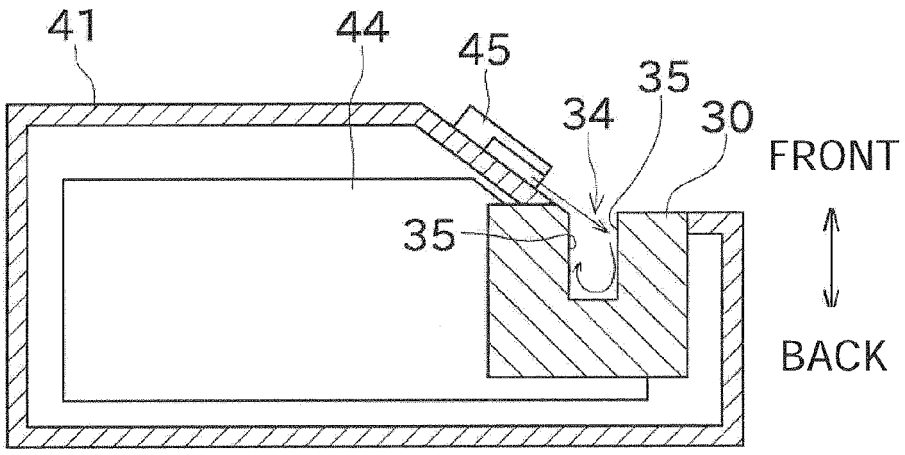
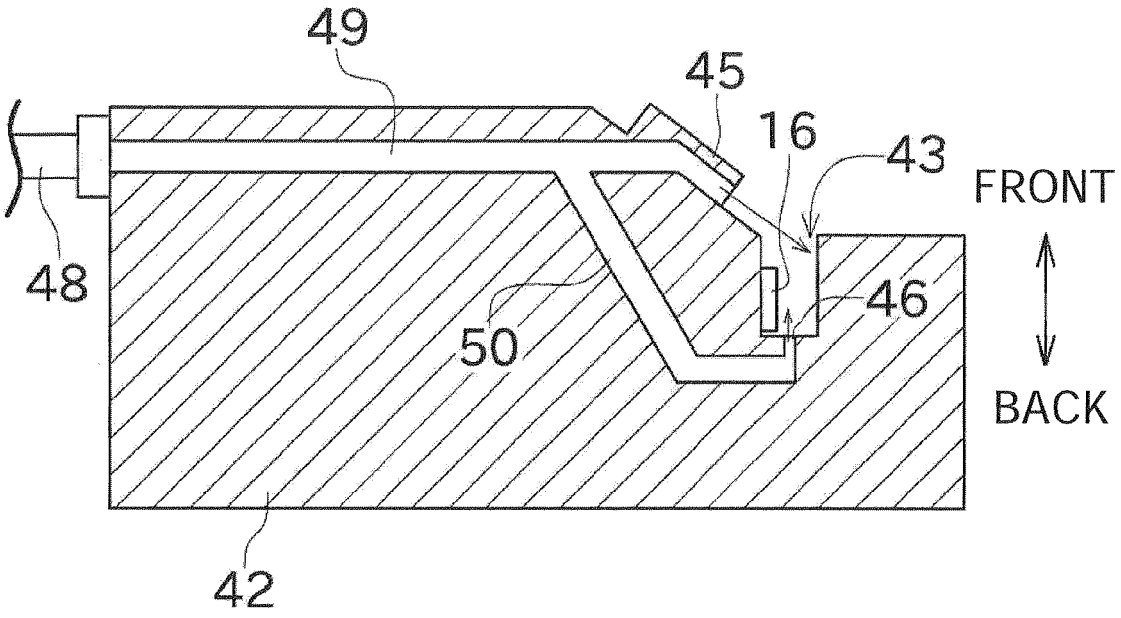

41
44
45
35
34
30
FRONT
35
BACK

FIG. 7



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005232650 A **[0003] [0005]**