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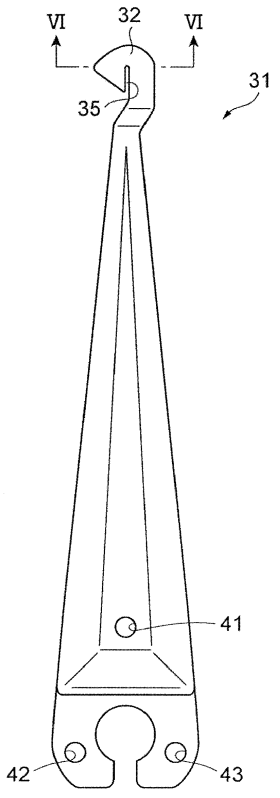
(54) TRAVERSE ARM AND YARN WINDING MACHINE

(57) A traverse arm (30) includes a body section (31) having a yarn guiding section (35) adapted to guide a yarn (Y), where a surface layer (44) having a hardness higher than that of the body section (31) is formed by performing surface treatment on a surface (31a) including at least the yarn guiding section (35) of the body section (31).

FIG. 5



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a traverse arm and a yarn winding machine

2. Description of the Related Art

[0002] The yarn winding machine includes a traverse device adapted to traverse a yarn to be wound around a winding bobbin. For example, Japanese Unexamined Patent Publication No. 2014-69931 discloses, as the traverse device, an arm type traverse device including a traverse arm adapted to swing. The traverse arm is provided with a traverse guide adapted to guide the yarn at a tip-end portion of an arm body.

[0003] The traverse guide may be subjected to abrasion by use since the traverse guide makes contact with the yarn. The traverse guide thus includes a guide member made of a material superior in abrasion resistance such as ceramic at a portion that makes contact with the yarn. The guide member is fixed to the traverse guide, for example, by an adhesive. In such a configuration, a gap may be formed between the traverse guide and the guide member depending on the adhered state, for example, and the yarn may get caught at the gap.

BRIEF SUMMARY OF THE INVENTION

[0004] It is an object of the present invention to provide a traverse arm and a yarn winding machine capable of preventing the yarn from getting caught while suppressing the abrasion caused by the contact with the yarn.

[0005] A traverse arm according to one aspect of the present invention is adapted to traverse a yarn by swinging, the traverse arm including a body section having a yarn guiding section adapted to guide the yarn, wherein a surface layer having a hardness higher than that of the body section is formed by performing surface treatment on a surface including at least the yarn guiding section of the body section.

[0006] The traverse arm has the surface layer formed on the surface of the yarn guiding section. The surface layer has a hardness higher than that of the body section. Thus, in the traverse arm, abrasion resistance of the yarn guiding section can be ensured. Since the abrasion resistance of the yarn guiding section can be ensured by the surface layer, the traverse arm does not need to include another member having abrasion resistance on the body section. Thus, a gap, a step, or the like that may become the cause of the yarn getting caught is not formed in the traverse arm. Therefore, the yarn can be prevented from getting caught.

[0007] In one embodiment, the surface layer may contain at least one of diamond like carbon, ceramic, titanium nitride, or hard chromium. The abrasion resistance can be ensured by forming the surface layer with such materials.

[0008] In one embodiment, the body section may be made of aluminum, aluminum alloy, magnesium, magnesium alloy, titanium, titanium alloy, or resin. The weight of the traverse arm thus can be lightened. Therefore, the speed of swinging of the traverse arm can be increased.

[0009] In one embodiment, the surface layer may be directly formed on the surface of the body section. Since an intermediate layer is not provided between the body section and the surface layer, the weight of the traverse arm becomes lighter. Furthermore, since the process for forming the intermediate layer is not required, the traverse arm can be more easily manufactured.

[0010] In one embodiment, the surface layer may be formed on the entire body section. When performing the surface treatment on a part of the body section, for example, the masking operation and the like are required, and hence the process becomes more complex. If the surface layer is formed over the entire body section, the masking operation and the like are not required, and thus the manufacturing can be simplified.

[0011] In one embodiment, the yarn guiding section is a cutout groove formed in the body section. Thus, the gap, the step, or the like to which the yarn gets caught is not formed by forming the yarn guiding section with the cutout groove. Therefore, the yarn can be further prevented from getting caught.

[0012] In one embodiment, the body section has the yarn guiding section at one end in a longitudinal direction of the body section, and has a center of swing located at the other end, and the yarn guiding section extends along the longitudinal direction and is opened in a direction of the other end. In one embodiment, the one end in the longitudinal direction of the body section may be formed into a hook shape.

[0013] A yarn winding machine according to another aspect of the present invention includes the above-described traverse arm; a driving section adapted to swing the traverse arm; and a winding section adapted to wind the yarn traversed by the swing of the traverse arm into a package.

[0014] In such a yarn winding machine, the traverse arm is provided. Thus, the yarn can be prevented from getting caught at the traverse arm when the traverse arm traverses the yarn by the drive of the driving section. As a result, the quality of the yarn to be wound into the package can be maintained.

[0015] In one embodiment, the traverse arm may be fixed to a drive shaft of the driving section. Thus, if the traverse arm is fixed to the drive shaft without interposing a gear and the like, the drive of the driving section is directly transmitted to the traverse arm, and thus the traverse arm can be accurately driven.

[0016] According to the present invention, the yarn can be prevented from getting caught while suppressing the abrasion caused by the contact with the yarn.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG. 1 is a front view of an automatic winder including a winder unit according to one embodiment;
FIG. 2 is a front view schematically illustrating the winder unit;
FIG. 3 is a side view illustrating a traverse device;
FIG. 4A is a side view of a traverse arm;
FIG. 4B is a front view of the traverse arm;
FIG. 4C is a perspective view of the traverse arm;
FIG. 5 is a view illustrating an arm body; and
FIG. 6 is a view illustrating a cross-sectional configuration taken along line VI-VI of FIG. 5.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0018] A preferred embodiment of the present invention will be hereinafter 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 redundant description will be omitted.

[0019] An overall configuration of an automatic winder 1 including a winder unit (yarn winding machine) 2 of the present embodiment will be described with reference to FIG. 1. In the following description, "upstream" and "downstream" respectively indicate upstream and downstream in a travelling direction of a yarn Y at the time of yarn winding.

[0020] As illustrated in FIG. 1, the automatic winder (yarn winding machine) 1 includes a plurality of winder units 2 arranged next to each another and a machine control device 4. The machine control device 4 is adapted to control (manage) the operation of the entire automatic winder 1. The automatic winder 1 may further include an automatic doffing device (not illustrated).

[0021] As illustrated in FIG. 2, each winder unit 2 includes a winding unit body 3 and a unit control section 17 as the main components.

[0022] The unit control section 17 is configured to include, for example, a Central Processing Unit (CPU), a Random Access Memory (RAM), a Read Only Memory (ROM), an Input-and-Output (I/O) port, and a communication port. The ROM stores a program for controlling each component of the winder unit 2. Each section (details will be described later) of the winder unit 2 and the machine control device 4 are connected to the I/O port and the communication port, thus enabling communication of control information and the like. The unit control section 17 thus can control an operation of each of the sections of the winder unit 2.

[0023] The winding unit body 3 includes a yarn supplying section 5, a yarn unwinding assisting device 7, a tension applying device 9, a yarn monitoring device 11, a yarn joining device 13, and a winding section 15 on a yarn travelling path between a yarn supplying bobbin 6 and a contact roller 22.

[0024] The yarn supplying section 5 is provided at a lower part of the winder unit 2. The yarn supplying section 5 is configured to hold the yarn supplying bobbin 6 fed by a bobbin feeding system (not illustrated) at a predetermined position.

[0025] The yarn unwinding assisting device 7 assists unwinding of the yarn Y from the yarn supplying bobbin 6 by lowering a regulating member 8 covering a core tube of the yarn supplying bobbin 6 in conjunction with the unwinding of the yarn Y from the yarn supplying bobbin 6. The regulating member 8 makes contact with a balloon of the yarn Y formed at an upper part of the yarn supplying bobbin 6 by rotation and a centrifugal force of the yarn Y unwound from the yarn supplying bobbin 6 to control the balloon of the yarn Y to an appropriate size, thus assisting the unwinding of the yarn Y. A sensor (not illustrated) for detecting a chase portion of the yarn supplying bobbin 6 is provided in proximity to the regulating member 8. When this sensor detects lowering of the chase portion, the yarn unwinding assisting device 7 lowers the regulating member 8 by an air cylinder (not illustrated), for example, following the lowering of the chase portion.

[0026] The tension applying device 9 applies a predetermined tension on the travelling yarn Y. The tension applying device 9 may be, for example, a gate type tension applying device in which movable comb teeth are arranged with respect to fixed comb teeth. Since the yarn Y bends and passes through between the engaged comb teeth, resistance is applied on the travelling yarn Y and thereby allowing an appropriate tension to be applied on the yarn Y. Other than the gate type tension applying device, a disc type tension applying device, for example, may be employed as the tension applying device 9.

[0027] The yarn monitoring device 11 includes a sensor (not illustrated) adapted to detect an abnormal portion (yarn defect) of the yarn Y. A cutter 12, which is adapted to immediately cut the yarn Y when the yarn monitoring device 11 detects the yarn defect, is provided in proximity to the yarn monitoring device 11.

[0028] The yarn joining device 13 joins a lower yarn from the yarn supplying bobbin 6 and an upper yarn from a winding bobbin 14 at the time of yarn cutting performed after the yarn monitoring device 11 detects a yarn defect, yarn breakage during unwinding of the yarn Y from the yarn supplying bobbin 6, and the like. The yarn joining device adapted to join the upper yarn and the lower yarn may be a mechanical knotter, a splicer using fluid such as compressed air, or the like.

[0029] A lower yarn catching member 16 adapted to catch a lower yarn and to guide the lower yarn to the yarn joining device 13 is arranged below the yarn joining device 13. An upper yarn catching member 18 adapted to catch an upper yarn and to guide the upper yarn to the yarn joining device 13 is arranged above the yarn joining device 13.

[0030] The winding section 15 includes a cradle 20

adapted to support the winding bobbin 14 for winding the yarn Y, and the contact roller 22 that rotates when brought into contact with a peripheral surface of the winding bobbin 14. The winding section 15 includes a rotary drive source (not illustrated) adapted to rotatably drive the winding bobbin 14 supported by the cradle 20. By driving and rotating the winding bobbin 14, the yarn Y can be wound around the outer periphery of the winding bobbin 14. The winding bobbin 14 around which the yarn Y is wound is referred to as a package P.

[0031] The winder unit 2 includes an arm type traverse device 24 in proximity to the cradle 20, the traverse device 24 being adapted to traverse the yarn Y to be wound around the winding bobbin 14. As illustrated in FIG. 3, the traverse device 24 includes a traverse drive motor (driving section) 26 and a traverse arm 30.

[0032] The traverse drive motor 26 is a drive source adapted to swing the traverse arm 30 and is configured by a servo motor and the like. The traverse drive motor 26 has a swing-drive shaft 28 as an output shaft. The swing-drive shaft 28 is connected to a base-end portion of the traverse arm 30 in a longitudinal direction of the traverse arm 30. The traverse arm 30 is fixed to the swing-drive shaft 28 in a relatively non-rotatable manner. As illustrated in FIG. 3, in a state where the traverse arm 30 is fixed to the swing-drive shaft 28, the longitudinal direction of the traverse arm 30 and the swing-drive shaft 28 are substantially perpendicular to each other.

[0033] A traverse guide 32 is provided at a tip-end portion of the traverse arm 30 (end portion opposite to the base-end portion in the longitudinal direction). The traverse guide 32 is formed into a shape by which the yarn Y to be wound around the winding bobbin 14 can be guided (shape by which the yarn Y can be arranged inside or shape by which the traverse guide 32 can hook the yarn Y).

[0034] Since a rotor of the traverse drive motor 26 repeats forward/reverse rotations and thereby swings the traverse arm 30 within a predetermined range with the swing-drive shaft 28 as a center, the traverse guide 32 reciprocates with respect to a direction of a winding width of the package P (left-right direction in FIG. 2). By rotating the winding bobbin 14 in a state where the yarn Y is guided by the traverse guide 32, the yarn Y is wound around the winding bobbin 14 while being traversed, thereby forming a predetermined-shaped package P.

[0035] Next, the traverse arm 30 will be described in detail. As illustrated in FIGS. 4A to 4C and FIG. 5, the traverse arm 30 includes an arm body (body section) 31 and a mounting member 33.

[0036] As illustrated in FIGS. 4A to 4C, the arm body 31 is formed into a tapered shape. In a longitudinal direction of the arm body 31, a side where the swing-drive shaft 28 is mounted and a side opposite thereof (side where the traverse guide 32 is formed) are respectively referred to as a "base-end (other end)" and a "tip-end (one end)". The arm body 31 is made of a processed plate member. In the present embodiment, the arm body 31 is made of a pressed aluminum plate or a pressed aluminum alloy plate. The material for forming the arm body 31 may be magnesium, magnesium alloy, titanium, titanium alloy, resin, or the like.

[0037] The traverse guide 32 is provided at a tip-end portion of the arm body 31. The traverse guide 32 and the arm body 31 are integrally molded. In other words, the traverse guide 32 is formed with the arm body 31 by processing an aluminum plate or an aluminum alloy plate by a press machine. The traverse guide 32 is formed into a shape by which the yarn Y can be guided by the traverse guide 32.

[0038] Specifically, the traverse guide 32 is formed into a hook shape.

[0039] A yarn guiding section 35 adapted to guide the yarn Y (to hook the yarn Y) is formed in the traverse guide 32. The yarn guiding section 35 is a cutout groove formed in the traverse guide 32. The yarn guiding section 35 extends along the longitudinal direction of the arm body 31 and is opened on a base-end side (direction of the base-end portion). The yarn Y to be traversed by the traverse device 24 slides and travels while making contact with the yarn guiding section 35.

[0040] The mounting member 33 is mounted to the base-end portion of the arm body 31. The mounting member 33 is mounted to the swing-drive shaft 28. In other words, the arm body 31 is fixed to the swing-drive shaft 28 via the mounting member 33. The arm body 31 has a center of the swing located at the base-end portion. The mounting member 33 is a member different from the arm body 31. The mounting member 33 is made of aluminum, for example, and is formed by using a cutting machine, and the like. The mounting member 33 is provided with a mounting hole 37 for mounting the swing-drive shaft 28. A key groove 39 for preventing the traverse arm 30 from relatively rotating with respect to the swing-drive shaft 28 is formed in the mounting hole 37.

[0041] The arm body 31 and the mounting member 33 are, for example, fixed by screws. The arm body 31 is provided with a plurality of (three herein) through holes 41, 42, 43, and the screws are screwed into the mounting member 33 via the through holes 41, 42, 43. The mounting member 33 is thereby mounted to the arm body 31.

[0042] As illustrated in FIG. 6, a surface layer 44 is formed on a surface 31a of the arm body 31 having the above-described configuration. In the present embodiment, the surface layer 44 is formed over the entire surface 31a of the arm body 31 including the yarn guiding section 35. The surface layer 44 is formed by surface treatment. The surface treatment is treatment performed on the surface 31a of the arm body 31 to enhance the abrasion resistance and the like of the surface 31a of the arm body 31. Specifically, the surface treatment is, for example, treatment for forming a film on the surface 31a of the arm body 31, or treatment for improving the surface 31a of the arm body 31.

[0043] The surface layer 44 includes a first layer 45 and a second layer 46. The first layer 45 is directly formed

on the surface 31a of the arm body 31, and the second layer 46 is formed on the first layer 45. The first layer 45 is, for example, chromium-based plating. The first layer 45 may be a single layer or may be a multi-layer. The component of the material of the first layer 45 may contain a gradient composition.

[0044] In the present embodiment, the second layer 46 is, for example, a film of DLC (Diamond Like Carbon), and is formed by plasma CVD. The arm body 31 is made black by the second layer 46 of the DLC. The second layer 46 has a hardness (Vicker's hardness) higher than that of the arm body 31. In the present embodiment, the arm body 31 is made of aluminum or aluminum alloy, and thus the hardness of the second layer 46 is higher than the hardness of aluminum or aluminum alloy (e.g., 50 Hv to 150 Hv). The hardness of the second layer 46 made of DLC is, for example, 1300 Hv or more and 1500 Hv or less. The thickness of the second layer 46 may be appropriately set, and is, for example, 5 μm or more and 10 μm or less.

[0045] As described above, the traverse arm 30 of the present embodiment has the surface layer 44 formed on the surface 31a of the arm body 31 including the yarn guiding section 35 by the surface treatment. The second layer 46 of the surface layer 44 has a hardness higher than that of the arm body 31. Thus, in the traverse arm 30, abrasion resistance of the yarn guiding section 35 can be ensured. Since the abrasion resistance of the yarn guiding section 35 can be ensured by the surface layer 44, the traverse arm 30 does not need to include another member having abrasion resistance on the traverse guide 32. Thus, a gap, a step, or the like that may become the cause of the yarn Y getting caught is not formed in the traverse arm 30. Therefore, the yarn Y can be prevented from getting caught.

[0046] In the present embodiment, the second layer 46 of the surface layer 44 is the film of the DLC. Thus, by forming the film of DLC on the surface 31a of the arm body 31, the abrasion resistance of the yarn guiding section 35 can be ensured.

[0047] In the present embodiment, the arm body 31 is made of aluminum or aluminum alloy. Therefore, the speed of swinging of the traverse arm 30 can be increased.

[0048] In the present embodiment, the surface layer 44 is formed over the entire surface 31a of the arm body 31. When performing the surface treatment on a part of the arm body 31, a masking operation and the like are required, and hence the process becomes more complex. If the surface layer 44 is formed over the entire surface 31a of the arm body 31, the masking operation and the like are not required, and thus the manufacturing can be simplified. Furthermore, if the surface layer 44 is formed over the entire surface 31a of the arm body 31, the surface layer 44 functions as a rust prevention (anti-corrosion layer), and hence rust prevention (anti-corrosion) treatment is not required to be separately performed on the traverse arm 30.

[0049] In the present embodiment, the yarn guiding section 35 is a cutout groove formed in the traverse guide 32. Therefore, the gap, the step, or the like to which the yarn Y gets caught is not formed.

[0050] In the present embodiment, the surface layer 44 includes the first layer 45. For example, the first layer 45 made of chromium-based plating has satisfactory adhesiveness with the surface 31a of the arm body 31 made of aluminum or aluminum alloy, and the second layer 46 made of DLC has satisfactory adhesiveness with the first layer 45. Therefore, stripping of the second layer 46 (the surface layer 44) can be prevented by providing the first layer 45.

[0051] The present invention is not limited to the above-described embodiment. For example, in the above-described embodiment, the film of DLC has been described by way of example as the second layer 46 of the surface layer 44. The second layer 46 of the surface layer 44 merely needs to have a hardness higher than that of the arm body 31, and may be made of, for example, ceramic, titanium nitride, hard chromium, or the like. Alternatively, the second layer 46 may be formed to contain a plurality of materials of the DLC, the ceramic, the titanium nitride, and the hard chromium.

[0052] In the case of the ceramic, the surface layer can be formed on the surface 31a of the arm body 31 by a plasma powder spraying method, an explosion spraying method, or the like. The hardness of the ceramic is, for example, 800 Hv or more and 850 Hv or less. The thickness of the surface layer made of ceramic is, for example, 30 μm or more and 200 μm or less.

[0053] In the case of titanium nitride, the surface layer can be formed on the surface 31a of the arm body 31 by a PVD ion plating method. The hardness of the titanium nitride is, for example, 2200 Hv or more and 2500 Hv or less. The thickness of the surface layer made of titanium nitride is, for example, 2 μm or more and 4 μm or less.

[0054] In the case of hard chromium, the surface layer can be formed on the surface 31a of the arm body 31 by a plating bath. The hardness of the hard chromium is, for example, 800 Hv or more and 1000 Hv or less.

[0055] In the above-described embodiment, a configuration in which the surface layer 44 includes the first layer 45 and the second layer 46 has been described by way of example. However, the first layer 45 may not be provided. In other words, if the surface layer 44 is formed by only one layer, i.e., the second layer 46, the second layer 46 may be directly formed on the surface 31a of the arm body 31. Since the first layer 45 is not provided between the surface 31a of the arm body 31 and the second layer 46, the weight of the traverse arm 30 becomes lighter. Furthermore, since the process of forming the first layer 45 is not required, the traverse arm 30 can be more easily manufactured.

[0056] In the above-described embodiment, a configuration in which the surface layer 44 includes the first layer 45 and the second layer 46 has been described by way of example, but the surface layer 44 may include

other layers.

[0057] In the above-described embodiment, a mode of forming the surface layer 44 over the entire surface 31a of the arm body 31 has been described by way of example, but the surface layer 44 merely needs to be formed on the surface 31a of at least the yarn guiding section 35.

[0058] In the above-described embodiment, the mounting member 33 is formed as a member different from the arm body 31, but may be integrally molded.

Claims

1. A traverse arm (30) adapted to traverse a yarn (Y) by swinging, the traverse arm (30) comprising:

   a body section (31) having a yarn guiding section (35) adapted to guide the yarn (Y),
   wherein a surface layer (44) having a hardness higher than that of the body section (31) is formed by performing surface treatment on a surface (31a) including at least the yarn guiding section (35) of the body section (31).

2. The traverse arm (30) according to claim 1, wherein the surface layer (44) contains at least one of diamond like carbon, ceramic, titanium nitride, or hard chromium.

3. The traverse arm (30) according to claim 1 or 2, wherein the body section (31) is made of aluminum, aluminum alloy, magnesium, magnesium alloy, titanium, titanium alloy, or resin.

4. The traverse arm (30) according to any one of claims 1 to 3, wherein the surface layer (44) is directly formed on the surface (31a) of the body section (31).

5. The traverse arm (30) according to any one of claims 1 to 4, wherein the surface layer (44) is formed on the entire body section (31).

6. The traverse arm (30) according to any one of claims 1 to 5, wherein the yarn guiding section (35) is a cutout groove formed in the body section (31).

7. The traverse arm (30) according to any one of claims 1 to 6, wherein the body section (31) has the yarn guiding section (35) at one end in a longitudinal direction of the body section (31), and has a center of swing located at the other end, and
   the yarn guiding section (35) extends along the longitudinal direction and is opened in a direction of the other end.

8. The traverse arm (30) according to any one of claims 1 to 7, wherein the one end in the longitudinal direction of the body section (31) is formed into a hook shape.

9. A yarn winding machine comprising:

   the traverse arm (30) according to any one of claims 1 to 8;
   a driving section (26) adapted to swing the traverse arm (30); and
   a winding section (15) adapted to wind the yarn (Y) traversed by the swing of the traverse arm (30) into a package (P).

10. The yarn winding machine according to claim 9, wherein the traverse arm (30) is fixed to a drive shaft (28) of the driving section (26).

FIG. 1

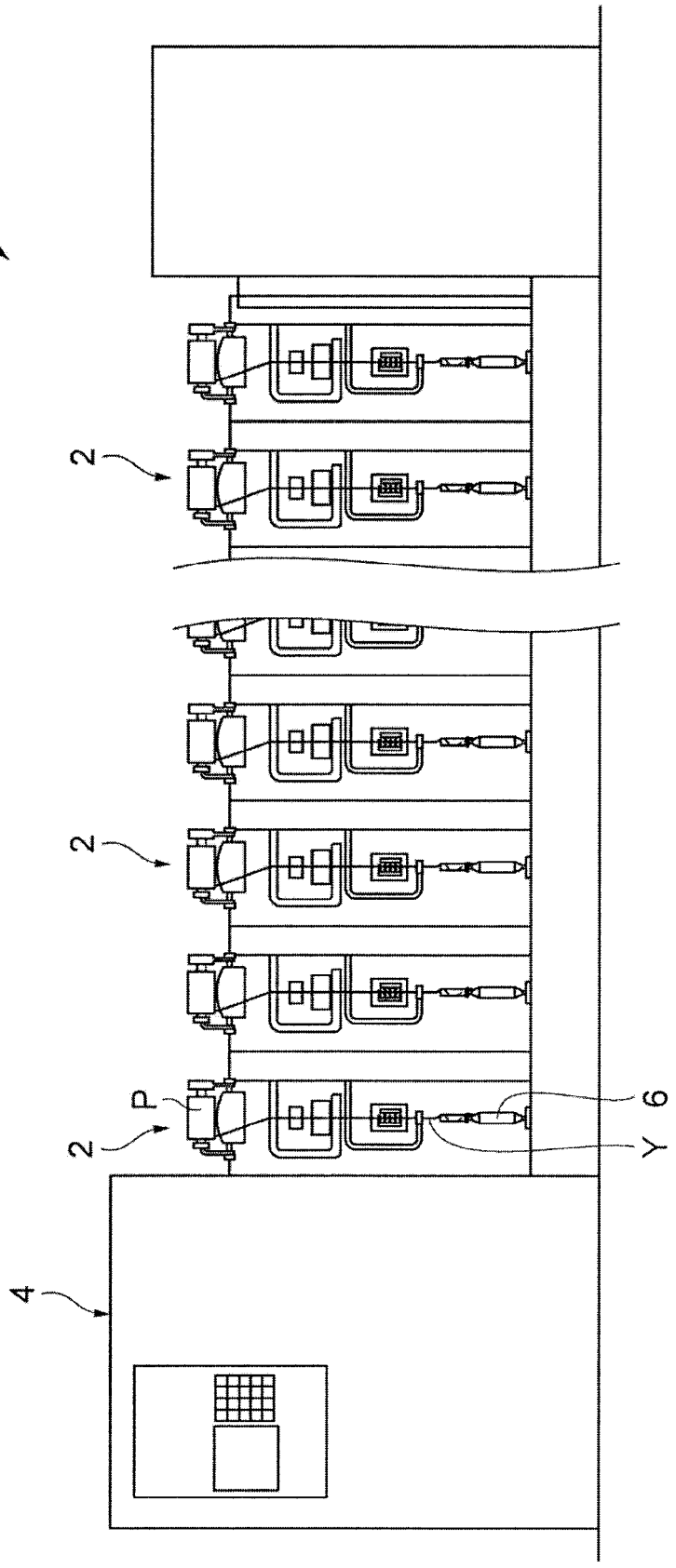

FIG. 2

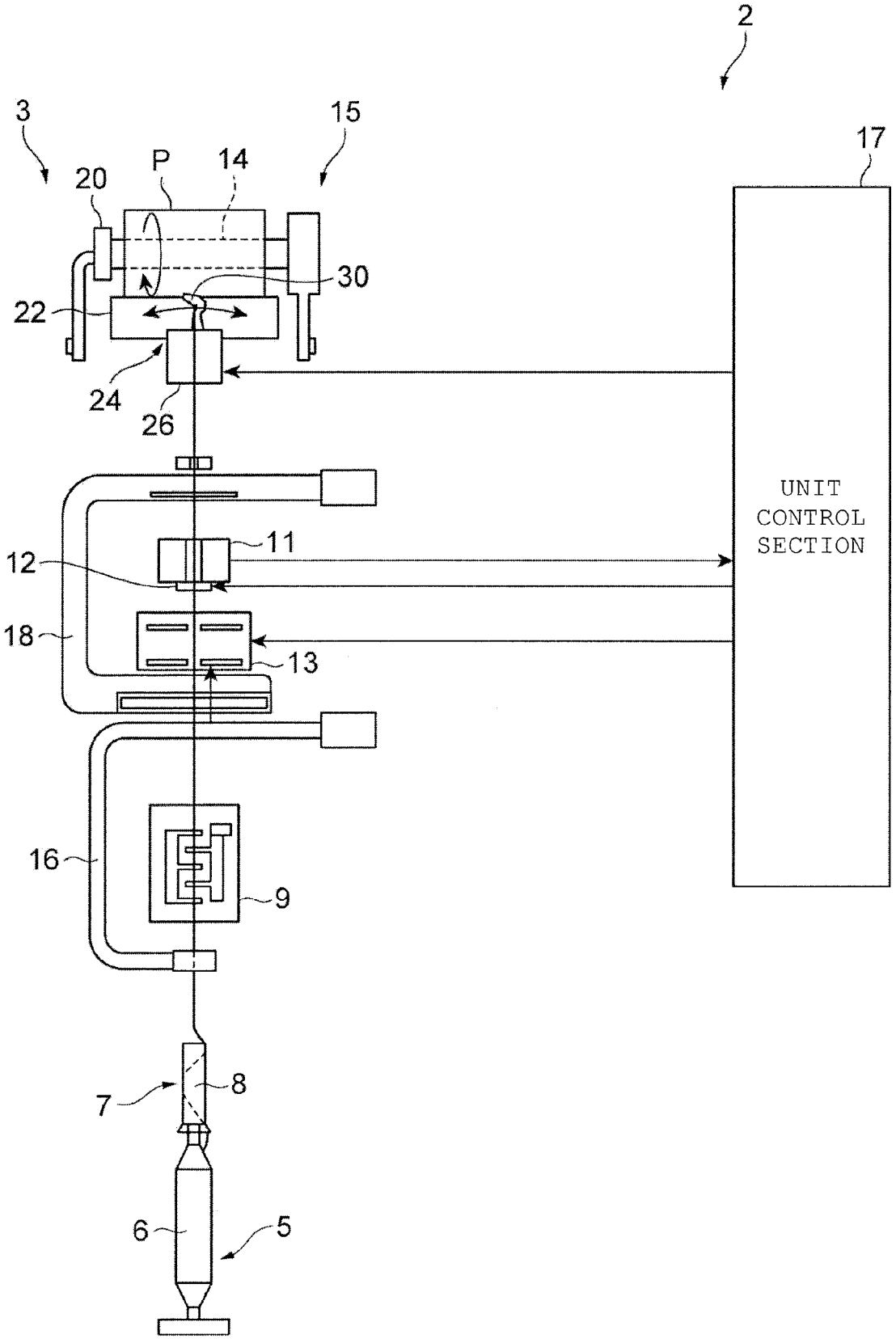
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FIG. 3

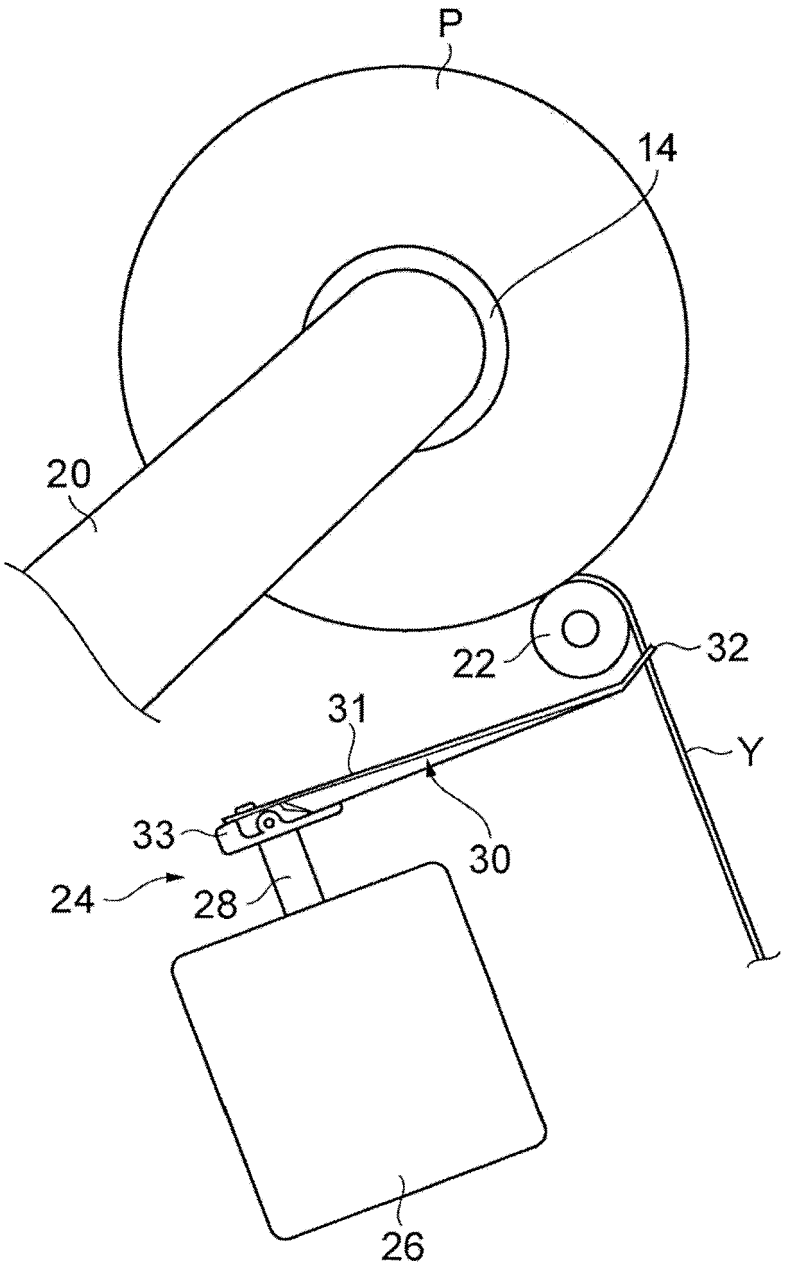


FIG. 4A

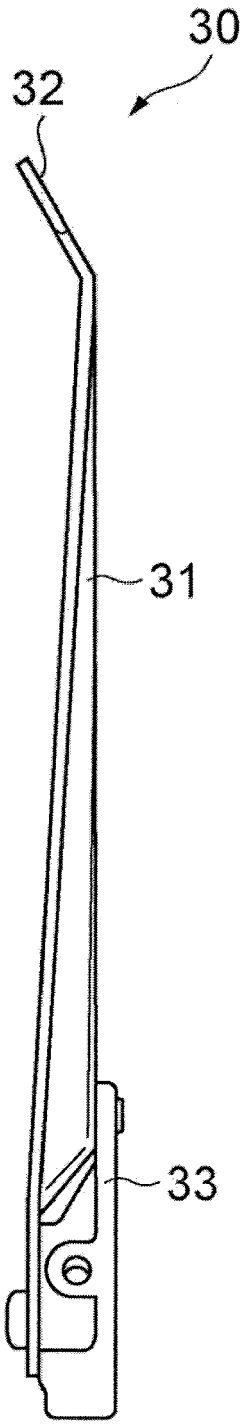


FIG. 4B

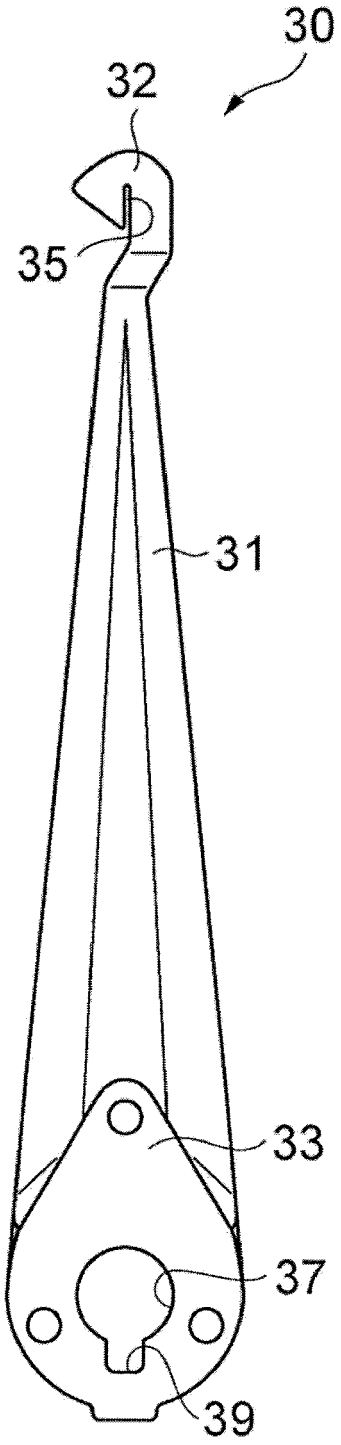


FIG. 4C

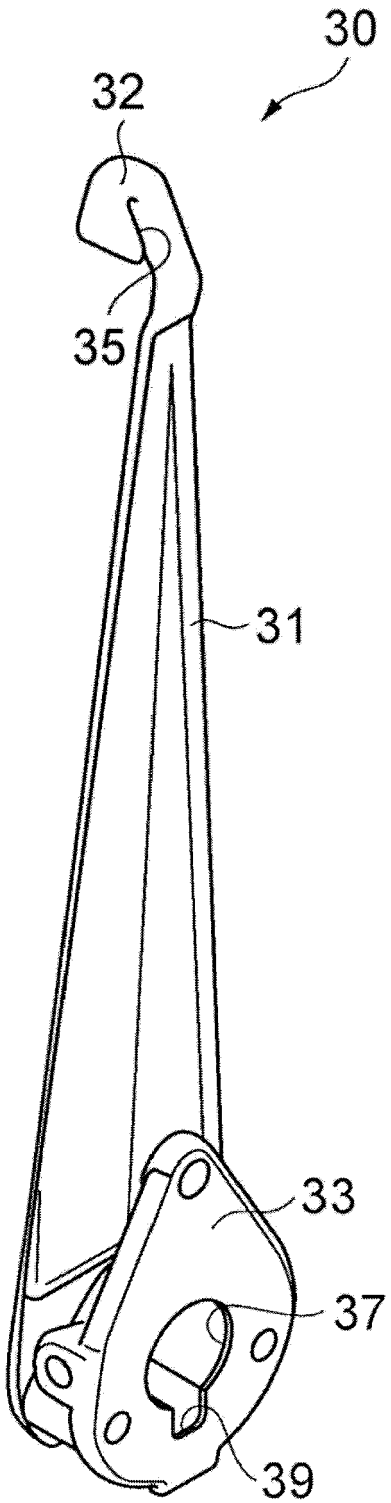


FIG. 5

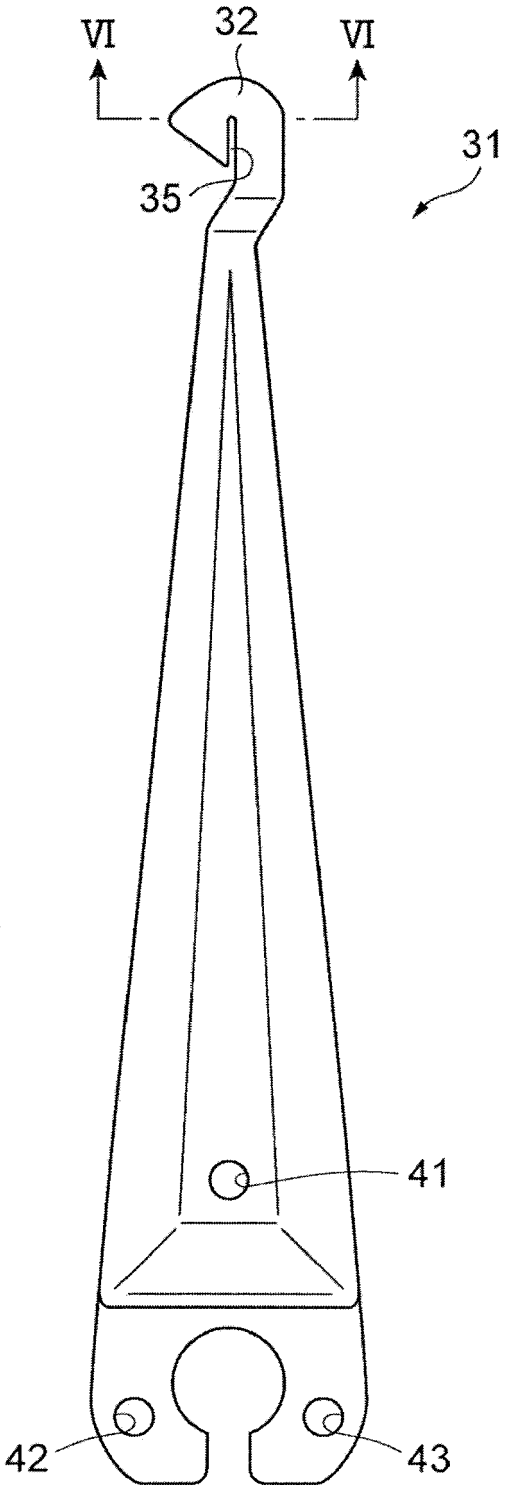
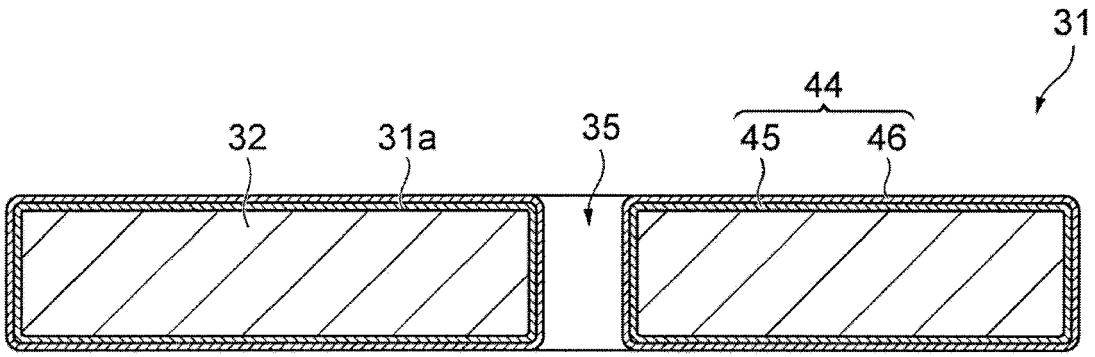


FIG. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 15 17 8002

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2007/007004 A2 (RIETER TEXTILE MACHINERY FR [FR]; AYRAULT XAVIER [FR]; MILORD CEDRIC [) 18 January 2007 (2007-01-18)	1-6,9,10	INV. B65H54/28 B65H57/24
Y	* page 8, paragraph 3 * * page 9, paragraph 4 - page 10, paragraph 1 *	7,8	
X	US 6 505 791 B1 (SYNDIKUS HEIKE [DE] ET AL) 14 January 2003 (2003-01-14) * column 11, lines 22-36 *	1-6,9,10	
X	EP 2 537 788 A1 (OERLIKON TEXTILE GMBH & CO KG [DE]) 26 December 2012 (2012-12-26) * paragraph [0010] *	1-4,6,9, 10	
Y	EP 2 570 377 A1 (MURATA MACHINERY LTD [JP]) 20 March 2013 (2013-03-20) * figure 4 *	7,8	

TECHNICAL FIELDS SEARCHED (IPC)
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 December 2015	Pussemier, Bart

CATEGORY OF CITED DOCUMENTS

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