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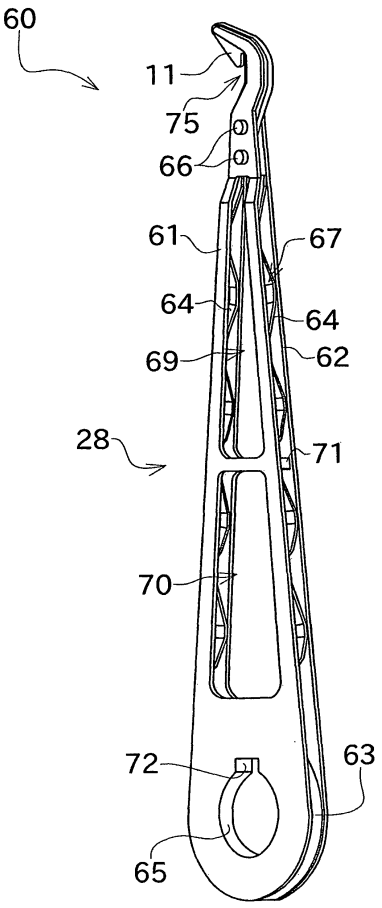
(54) Traverse arm and yarn winding machine including the same

(57) A traverse arm 28 includes a first plate 61, a second plate 62, which are arranged to face one another in a direction orthogonal to a traverse direction of the traverse arm 28, and a beam 64, which connects the first plate 61 and the second plate 62 to form a truss structure. Space arranged between the beams 64, which form the truss structure, functions as space 67 (penetration hole) for having air pass through in the traverse direction of the traverse arm 28.

FIG. 2



EP 2 196 423 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a structure of a traverse arm that supports a yarn guide.

2. Description of the Related Art

[0002] A conventionally-known yarn winding machine winds yarn into a package while traversing the yarn by traversing (swinging) a traverse arm, which supports a yarn guide for traversing the yarn, by a drive unit. In such a yarn winding machine, it is preferable to reduce weight of the traverse arm in order to increase speed of a winding operation of the package and to improve quality of the package, or the like.

[0003] Patent Document 1 (Japanese Unexamined Patent Application Publication No. 2002-518276) and Patent Document 2 (brochure of International Publication No. 2007/007004) disclose such a weight-reduced traverse arm. Patent Document 1 discloses, for example, a traverse arm having a hollow zone therein and a traverse arm having a sandwich structure in which a relatively light-weighted filling material is sandwiched between plate-like members, or the like. Patent Document 2 discloses a traverse arm in which penetration holes are formed in a plane of the traverse arm that is parallel to a swinging direction of the traverse arm.

[0004] However, even in such a traverse arm made in consideration of weight reduction as disclosed in Patent Documents 1 and 2, when the traverse arm is driven, air resistance generates relative to a moving direction (to a side surface portion). Accordingly, it has been difficult to effectively increase speed of a traverse movement of a traverse guide. Moreover, rigidity of the traverse arm may be lowered by such weight reduction, and the traverse arm may be damaged during the traversing operation or the like.

SUMMARY OF THE INVENTION

[0005] In order to overcome the problems described above, preferred embodiments of the present invention achieve a high-speed traversing operation while reducing burden on a driving section of a traverse arm that supports a yarn guide for traversing yarn.

[0006] According to a first aspect of the present invention, in a traverse arm that supports a yarn guide for traversing yarn, a penetration hole is formed on the traverse arm for having air pass through in a traverse direction of the traverse arm. Thus, the traverse arm can be reduced in weight, and air resistance that generates in a traverse direction when the traverse arm is driven can also be reduced. As a result, burden imposed when the traverse arm is traversed can be reduced.

[0007] The traverse arm preferably includes at least a pair of supporting members that are arranged to face one another in a direction orthogonal to the traverse direction of the traverse arm, and a beam member that connects the plurality of supporting members to form a truss structure. The penetration hole is formed by the supporting members and the beam member. Thus, rigidity of the traverse arm can be improved by the truss structure, and the penetration hole can be simply formed without a special process.

[0008] In the traverse arm, the yarn guide is preferably fixed by being sandwiched in the traverse arm. Thus, a structure for holding the yarn guide can be simplified. Further, since the yarn guide and the traverse arm are provided as separate members, materials of the traverse arm and the yarn guide may be appropriately selected in accordance with usage and circumstances.

[0009] According to a second aspect of the present invention, a yarn winding machine includes the above-described traverse arm and a driving section. Thus, acceleration performance of a traverse device can be improved by using the traverse arm that is light-weighted and that can reduce air resistance, and the burden on the driving section can also be reduced. As a result, the traverse speed can be increased, and the productivity of the package of the yarn winding machine can be improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Fig. 1 is a schematic view and a block diagram schematically illustrating a winder unit of an automatic winder according to an embodiment of the present invention.

[0011] Fig. 2 is a perspective view of a traverse guide according to the embodiment of the present invention.

[0012] Fig. 3 is a front view of the traverse guide according to the embodiment of the present invention.

[0013] Fig. 4 is a side view of the traverse guide according to the embodiment of the present invention.

[0014] Fig. 5 is an enlarged side view of a tip end side of the traverse guide.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0015] Preferred embodiments of the present invention will be described with reference to the drawings. A winder unit 10 illustrated in Fig. 1 winds yarn 20, which is unwound from a yarn supply bobbin 21, around a cone-shaped winding bobbin 22 while traversing the yarn 20 so as to form a package 30 of a prescribed shape and prescribed length. The winding bobbin 22 is not limited to the cone shape, and may be cylindrically-shaped, or the like. In the present preferred embodiment, an automatic winder (yarn winding machine) includes a plurality of aligned winder units 10, a not-illustrated machine control device arranged at one end of a direction of such

alignment, and a not-illustrated setter arranged on a front side of the machine control device.

[0016] Each of the winder units 10 includes a winding unit main body 16 and a unit control section 50.

[0017] For example, the unit control section 50 includes a Central Processing Unit (CPU), a Random Access Memory (RAM), a Read Only Memory (ROM), and an Input and Output (I/O) port. The ROM stores a program for controlling each component of the winding unit main body 16. In addition to the setter, each component (to be described later) of the winding unit main body 16 is connected to the I/O port, and control information can be communicated.

[0018] The winding unit main body 16 includes a yarn unwinding assisting device 12, a tension applying device 13, a splicer device 14, and a clearer (yarn quality measuring device) 15, which are arranged on a yarn traveling path between the yarn supply bobbin 21 and a contact roller 29 in this order from the yarn supply bobbin 21.

[0019] The yarn unwinding assisting device 12 lowers a regulating member 40, which covers a core tube of the yarn supply bobbin 21, in conjunction with unwinding of yarn from the yarn supply bobbin 21 so as to assist such unwinding of the yarn from the yarn supply bobbin 21. The regulating member 40 makes contact with a balloon that is formed at an upper portion of the yarn supply bobbin 21 by rotation and centrifugal force of the yarn unwound from the yarn supply bobbin 21, and thus, assists the yarn unwinding by controlling the balloon to be an appropriate size. A not-illustrated sensor for detecting a chase portion of the yarn supply bobbin 21 is provided near the regulating member 40. When the sensor detects the lowering of the chase portion, accompanying such detection, the regulating member 40 can be lowered by, for example, an air cylinder (not illustrated).

[0020] The tension applying device 13 applies prescribed tension to the traveling yarn 20. The tension applying device 13 may be a gate type in which movable comb-teeth 37 are arranged relative to fixed comb-teeth 36. For example, the movable comb-teeth 37 can be operated by a rotary solenoid 38 so that the comb-teeth 36 and 37 can be engaged with or disengaged from one another. The tension applying device 13 can apply certain tension to the yarn 20 to be wound, which thereby improves the quality of the package 30. In addition to the gate type, for example, the tension applying device 13 may be a disk type.

[0021] The splicer device 14 splices a lower yarn from the yarn supply bobbin 21 and an upper yarn from the package 30 at the time of yarn cutting performed when a yarn defect is detected by the clearer 15 or at the time of yarn breakage that occurs while unwinding the yarn from the yarn supply bobbin 21. A yarn splicing device that splices the upper yarn and the lower yarn may be a mechanical type or a type using fluid such as compressed air, or the like.

[0022] The clearer 15 includes a clearer head 49 and an analyzer 52. The clearer head 49 includes a not-illustrated sensor for detecting a thickness of the yarn 20. The analyzer 52 processes a yarn thickness signal sent from the sensor. The clearer 15 monitors the yarn thickness signal sent from the sensor in order to detect a yarn defect such as slub or the like. A cutter 39 is provided near the clearer head 49. The cutter 39 immediately cuts the yarn 20 when the clearer 15 detects the yarn defect.

[0023] A lower yarn guide pipe 25 is provided below the splicer device 14 to catch and guide the lower yarn from the yarn supply bobbin 21 to the splicer device 14. An upper yarn guide pipe 26 is provided above the splicer device 14 to catch and guide the upper yarn from the package 30 to the splicer device 14. The lower yarn guide pipe 25 and the upper yarn guide pipe 26 can swing around shafts 33 and 35, respectively. A suction opening 32 is provided at a tip end of the lower yarn guide pipe 25. A suction mouth 34 is provided at a tip end of the upper yarn guide pipe 26. An appropriate negative pressure source is connected with each of the lower yarn guide pipe 25 and the upper yarn guide pipe 26 to generate suction flow in the suction opening 32 and the suction mouth 34, and thus, yarn ends of the upper yarn and the lower yarn can be sucked and caught.

[0024] The winding unit main body 16 includes a cradle 23 and the contact roller 29. The cradle 23 removably supports the winding bobbin (a paper tube or the core tube) 22. The contact roller 29 can be driven and rotated in contact with a circumferential surface of the winding bobbin 22 or a circumferential surface of the package 30. The winding unit main body 16 includes an arm-type traverse device 27 for traversing the yarn 20. The traverse device 27 is provided near the cradle 23. The winding unit main body 16 winds the yarn 20 into the package 30 while traversing the yarn 20 by the traverse device 27.

[0025] The cradle 23 can swing around a swing shaft 48. Thus, an increase in a yarn layer diameter accompanying the winding of the yarn 20 around the winding bobbin 22 can be absorbed by the swinging of the cradle 23. Further, as illustrated in Fig. 1, the cradle 23 and the traverse device 27 can form a cone-shaped package 30. The winder unit 10 can also form a cheese-shaped package by using a cylindrical winding bobbin 22.

[0026] A package driving motor 41 is attached to a portion where the cradle 23 grips and supports the winding bobbin 22. The package driving motor 41 rotationally drives the winding bobbin 22 to wind the yarn 20 into the package 30. When the winding bobbin 22 is supported by the cradle 23, a motor shaft of the package driving motor 41 is connected with the winding bobbin 22 such that the motor shaft cannot relatively rotate (direct driving method). A package drive control section 42 controls an operation of the package driving motor 41. More specifically, the package drive control section 42 receives an operation signal from the unit control section 50, and controls operation/stoppage of the package driving motor 41.

[0027] A package rotation sensor 43 is attached to the cradle 23. The package rotation sensor 43 detects rota-

tion of the winding bobbin 22 (i.e., rotation of a yarn layer 31 formed around the winding bobbin 22) held by the cradle 23. A rotation detection signal of the winding bobbin 22 is transmitted from the package rotation sensor 43 to the package drive control section 42 and to the unit control section 50. Further, the rotation detection signal is input to a later-described traverse control section 46.

[0028] An angle sensor (a package diameter acquiring section) 44 for detecting an angle (swing angle) of the cradle 23 is attached to the swing shaft 48. For example, the angle sensor 44 includes a rotary encoder. The angle sensor 44 transmits an angle signal corresponding to the angle of the cradle 23 to the unit control section 50. The angle of the cradle 23 changes according to an increase in winding diameter of the package 30. Therefore, by detecting the swing angle of the cradle 23 by the angle sensor 44, a diameter of the yarn layer 31 of the package 30 can be detected. Thus, by controlling the traverse device 27 in accordance with the diameter of the package yarn layer, the yarn traversing operation can be appropriately performed. Further, the diameter of the yarn layer 31 acquired by the angle sensor 44 is transferred from the unit control section 50 to the package drive control section 42.

[0029] The traverse device 27 primarily includes a traverse guide 60 and a traverse guide driving motor (driving section) 45. The traverse guide 60 includes a traverse arm 28 and a yarn guide 11. The traverse arm 28 is formed as an elongate arm that can swing around a supporting shaft. The yarn guide 11 is supported at a tip end of the traverse arm 28 and has a hook shape. The traverse guide driving motor 45 drives the traverse arm 28 and is formed of, for example, a servomotor. The traverse device 27 reciprocates the traverse arm 28 as indicated by an arrow of Fig. 1 to traverse the yarn 20. A detailed structure of the traverse arm 28 and the yarn guide 11 will be described later.

[0030] The traverse control section 46 controls the operation of the traverse guide driving motor 45. The traverse control section 46 includes hardware or the like such as a special micro processor, and receives a signal from the unit control section 50 to control the operation/stoppage of the traverse guide driving motor 45.

[0031] The traverse device 27 includes a traverse guide position sensor 47 such as a rotary encoder. The traverse device 27 detects a traverse position of the traverse arm 28 (i.e., a position of the yarn guide 11) by the traverse guide position sensor 47 and transmits a position signal to the traverse control section 46.

[0032] Next, with reference to Figs. 2 through 5, the traverse guide 60 including the traverse arm 28 and the yarn guide 11 will be described.

[0033] The traverse arm 28 according to the present embodiment is made from Carbon Fiber Reinforced Plastics (CFRP). The yarn guide 11 is sandwiched in a tip end portion of the traverse arm 28, and the traverse arm 28 is mounted to the traverse guide driving motor 45. The traverse arm 28 primarily includes a first plate (cover member, supporting member) 61, a second plate (cover member, supporting member) 62, and a beam 64.

[0034] In a front view of Fig. 3, the first plate 61 is formed as an elongate plate-like member that tapers off from a base end where an output shaft of the traverse guide driving motor 45 is connected towards the tip end where the yarn guide 11 is sandwiched. On the first plate 61, substantially trapezoidal first penetration hole 69 and second penetration hole 70 are vertically aligned. A holding section for holding the yarn guide 11 is formed at a tip end portion of the first plate 61. The holding section curves substantially in the shape of a capital letter J in accordance with the shape of the hook-shaped yarn guide 11. Two positioning holes are formed near the holding section and aligned in a longitudinal direction. The two positioning holes are used for positioning the yarn guide 11 and fixing the position of the yarn guide 11.

[0035] Similarly to the first plate 61, the second plate 62 is also formed as an elongate plate-like member that tapers off from a base end towards a tip end. Two substantially trapezoidal penetration holes are formed on the second plate 62 and vertically aligned such that the shape and position thereof correspond to that of the penetration holes 69 and 70 of the first plate 61.

[0036] At each of the base end portions of the first plate 61 and the second plate 62, a shaft hole 65 for inserting the output shaft of the traverse guide driving motor 45 and a key groove 72 for connecting a key are provided.

[0037] The beam 64 is provided to connect the first plate 61 and the second plate 62 that are arranged parallel to each other with appropriate space (interval) therebetween. The beam 64 is provided at each side portion in a width direction of the traverse arm 28. More specifically, the beam 64 is an elongate plate-like member that is alternately folded several times. As illustrated in Fig. 2, the beam 64 is provided between the first plate 61 and the second plate 62 at each side in the width direction of the traverse arm 28. Each of the beams 64 is provided substantially entirely in the longitudinal direction of the traverse arm 28 except for the base end portion and the tip end portion of the traverse arm 28.

[0038] As illustrated in a side view of Fig. 4, the beam 64 is formed in a zigzag shape between the first plate 61 and the second plate 62. The beams 64, the first plate 61, and the second plate 62 together form a truss structure. Accordingly, since the first plate 61 and the second plate 62 are connected by the two beams 64 that form the truss structure, while realizing weight reduction, rigidity of the traverse arm 28 can be maintained in good condition.

[0039] As illustrated in Figs. 2 and 4, at a position located between the first penetration hole 69 and the second penetration hole 70, an intermediate beam 71 is provided between the first plate 61 and the second plate 62 entirely in the width direction of the traverse arm 28. The intermediate beam 71 is an elongate plate-like member that is alternately folded several times. The intermediate beam 71, the first plate 61, and the second plate 62 to-

gether form a truss structure between the first penetration hole 69 and the second penetration hole 70. Accordingly, the first plate 61 and the second plate 62 are connected by the truss structure also in a crosswise (short) direction of the traverse arm 28. As a result, the rigidity of the traverse arm 28 can be further increased.

[0040] Under a state in which the first plate 61 and the second plate 62 are connected to the traverse guide driving motor 45, the first plate 61 and the second plate 62 face one another in a direction of the output shaft of the traverse guide driving motor 45 (a supporting shaft and a rotational shaft of the traverse arm 28). In other words, the first plate 61 and the second plate 62 face one another in a direction that is orthogonal to the direction in which the traverse arm 28 is driven and moved by the traverse guide driving motor 45.

[0041] As illustrated in the side view of Fig. 4, the space between the first plate 61 and the second plate 62 is sectioned by the beams 64. Thus, a plurality of pieces of space (penetration holes) 67 are formed inside the traverse arm 28, each penetrating in the width direction of the traverse arm 28 (i.e., in a direction along the traverse direction of the traverse arm 28). Therefore, when the traverse arm 28 is swung (reciprocated), air passes through the space 67 from one side to another side of the traverse arm 28. Thus, air resistance relative to the sides of the traverse arm 28 (i.e., air resistance that generates in the moving direction of the traverse arm 28) can be reduced, which thereby prevents decrease in traverse speed of the traverse arm 28 resulting from windage loss and enables high-speed movement of the traverse arm 28.

[0042] In particular, in the present embodiment, a thickness direction of the plate-like member of the beam 64 is arranged orthogonal to the traverse direction of the traverse arm 28. Accordingly, large space can be obtained as the space 67, and the air can pass through the space in good condition. As a result, the decrease in the traverse speed of the traverse arm 28 resulting from windage loss can be further reduced.

[0043] An aluminum circular member 63 is fixed near the shaft hole 65 of the traverse arm 28 (i.e., at the base end portion of the traverse arm 28) by being sandwiched between the first plate 61 and the second plate 62. A penetration hole having a shape that corresponds to the shaft hole 65 and the key groove 72 of the traverse arm 28 is formed at the center of the circular member 63. By arranging the aluminum circular member 63 at a portion where the motor output shaft and the traverse arm 28 are connected and by sandwiching the circular member 63 between the first plate 61 and the second plate 62, the base end portion of the traverse arm 28 where great burden (load) accompanying the swinging is imposed can be effectively reinforced.

[0044] Next, the yarn guide 11 supported at the tip end portion of the traverse arm 28 will be described. The yarn guide 11 is made from ceramic or the like in a hooked shape. The yarn guide 11 is supported by being sandwiched at the tip end portion of the traverse arm 28. More specifically, as illustrated in Fig. 5, the yarn guide 11 is fixed to the tip end portion of the traverse arm 28 by being connected or adhered while being sandwiched in a direction of the swing shaft by the first plate 61, which is arranged on a front side, and the second plate 62, which is arranged on a rear side. Moreover, as illustrated in Fig. 3, a yarn hooking groove 75 is formed on the yarn guide 11 to hook the yarn. The yarn hooking groove 75 and the vicinity thereof are exposed as if protruding from the first plate 61 (the traverse arm 28).

[0045] Two positioning protrusions 66 protruding towards the front side are aligned on the yarn guide 11 in the longitudinal direction of the traverse arm 28. By adjusting the two positioning protrusions 66 respectively to the two positioning holes of the first plate 61, the yarn guide 11 can be supported at an appropriate position by the traverse arm 28.

[0046] During the winding operation, since the yarn guide 11 reciprocates always in contact with the yarn 20, static electricity can be produced by friction. Such static electricity can cause adhesion of a yarn waste and dust or the like to the yarn guide 11 or can influence on peripheral electronic devices. However, since the traverse arm 28 according to the present embodiment is made from CFRP, which is electrical conducting material, the static electricity produced by the contact between the yarn 20 and the yarn guide 11 can be discharged to the traverse arm 28. Further, in the present embodiment, in order to reliably support the yarn guide 11, a large contact area is provided between the traverse arm 28 and the yarn guide 11. Therefore, static electricity can be effectively discharged. Accordingly, problems from influence of the above-described static electricity can be prevented, and the winding operation can be performed more effectively.

[0047] As described above, the penetrating space 67 for having the air pass through in the traverse direction of the traverse arm 28 is formed in the traverse arm 28, which supports the yarn guide 11. Thus, the traverse arm 28 can be reduced in weight, and the air resistance that generates in the moving direction when the traverse arm 28 is driven can also be reduced. Therefore, the burden imposed when the traverse arm 28is reciprocated can be reduced.

[0048] The traverse arm 28 according to the present embodiment includes the first plate 61, the second plate 62, and the beams 64. The first plate 61 and the second plate 62 face one another in the direction orthogonal to the traverse direction of the traverse arm 28. The beams 64 form the truss structure by connecting the first plate 61 and the second plate 62. The penetrating space 67 is formed between the first plate 61 and the second plate 62 by the space formed by the beams 64, which form the truss structure.

[0049] Thus, the rigidity of the traverse arm 28 can be improved by the truss structure, and the penetrating space 67 can be simply formed without a special process.

Accordingly, as in the present embodiment, even in the case where the first penetration hole 69 and the second penetration hole 70 are formed on a surface that is parallel to the traverse direction of the traverse arm 28, certain rigidity can be maintained for the traverse arm 28.

[0050] In the traverse arm 28 according to the present embodiment, the yarn guide 11 is fixed by being sandwiched in the traverse arm 28. Thus, the structure for supporting the yarn guide 11 can be simplified. Since the yarn guide 11 and the traverse arm 28 are separate members, material of the traverse arm 28 and the yarn guide 11 can be appropriately selected in accordance with usage and circumstances. In the present embodiment, ceramic is used for the yarn guide 11, and CFRP is used for the traverse arm 28. As a result, weight reduction can be achieved, and also, the static electricity generated by the traversing operation can be effectively discharged.

[0051] The winder unit 10 (automatic winder) according to the present embodiment includes the traverse device 27 having the traverse arm 28 and the traverse guide driving motor 45. Thus, acceleration performance of the traverse device 27 can be improved by using the traverse arm 28 that is light-weighted and that can reduce the air resistance, and the burden on the traverse guide driving motor 45 can be reduced. As a result, productivity of the package 30 of the automatic winder can be improved by increasing the traverse speed.

[0052] The preferred embodiment of the present invention has been described above, however, the above-described structure can be modified as follows.

[0053] The traverse arm 28 according to the above-described embodiment is made from CFRP, however, for example, the following materials may be used for the traverse arm. That is, the traverse arm 28 may be made from composite materials such as other inorganic fiber (glass fiber or ceramic fiber) and organic fiber (such as aramid fiber, poly-phenylene-benzobisoxazole (PBO) fiber, and ultrahigh molecular weight polyethylene), and alloy materials including lightweight metal (magnesium, beryllium, aluminum, and titanium), or the like.

[0054] In the traverse arm 28 according to the above-described embodiment, the space 67 is formed by the truss structure, however, in place of such a configuration, for example, the space can be formed by providing a penetration hole in the width direction inside the traverse arm. In such a case, the penetration hole provided as an air passing hole may include opening at each side surface in the width direction of the traverse arm.

[0055] The shape of the traverse arm 28 according to the above-described embodiment may be appropriately modified. For example, three or more penetration holes may be formed on the traverse arm, or no penetration hole may be formed by omitting the first penetration hole 69 and the second penetration hole 70.

[0056] The shape of the yarn guide 11 according to the above-described embodiment may be appropriately modified in accordance with circumstances. For example, a portion of the yarn guide for hooking the yarn may be formed in a U-shape having an opening at a tip end or the yarn guide may be formed from two rod-shaped members that grip and traverse the yarn.

[0057] In place of the structure in which the winding bobbin 22 is directly driven by the package driving motor 41, the contract roller 29 may be driven by a motor and the package 30 may be rotated by such a driven contact roller 29. In place of the servomotor, the traverse guide driving motor 45 may be, for example, a voice coil motor or a step motor.

[0058] In the above-described embodiment, Fig. 4 illustrates the beam 64 in a uniformly (evenly) zigzag shape. However, such a zigzag shape may be unevenly formed as long as the beams 64, the first plate 61, and the second plate 62 form the truss structure as a whole, and the air resistance, which generates in the moving direction when the traverse arm 28 is driven, can be reduced. Further, the number of the pieces of the space 67 (penetration holes) formed by the beams 64, the first plate 61, and the second plate 62 is not limited to the number illustrated in the drawings, and may be appropriately increased or reduced.

[0059] In the above-described embodiment, the traverse guide is positioned relative to the traverse arm 28 (first plate 61) by the two positioning protrusions, however, one positioning protrusion or three or more positioning protrusions may be provided. That is, a structure of the positioning protrusions may be appropriately modified. For example, in the above-described embodiment, a positioning protrusion may be added to a rear surface of the traverse guide 60 so as to also position the second plate 62.

[0060] In the above-described embodiment, the first plate 61 and the second plate 62 are arranged parallel to each other with appropriate space (interval) therebetween. However, such arrangement is not limited to that of the above-described embodiment, and the first plate 61 and the second plate 62 may be arranged such that the space (interval) therebetween tapers off towards the tip end with at least certain space provided for the beams 64 to be arranged therein.

Claims

1. A traverse arm, which supports a yarn guide (11) for traversing yarn, the traverse arm (28) being **characterized by** penetration hole (67) being formed to have air pass through in a traverse direction of the traverse arm (28).

2. The traverse arm according to claim 1, **characterized by** comprising:

   at least one pair of supporting members (61, 62) that are arranged to face one another in a direction orthogonal to the traverse direction of the traverse arm (28), and

a beam member (64) that connects the supporting members (61, 62) to form a truss structure,

characterized in that the penetration hole (67) is formed by the supporting members (61, 62) and the beam member (64).

3. The traverse arm according to claim 1 or claim 2, **characterized in that** the yarn guide (11) is fixed by being sandwiched in the traverse arm (28).

4. A yarn winding machine comprising a traverse device (27) including the traverse arm (28) according to any one of claim 1 through claim 3, and a driving means (45) for driving the traverse arm (28).

FIG. 1

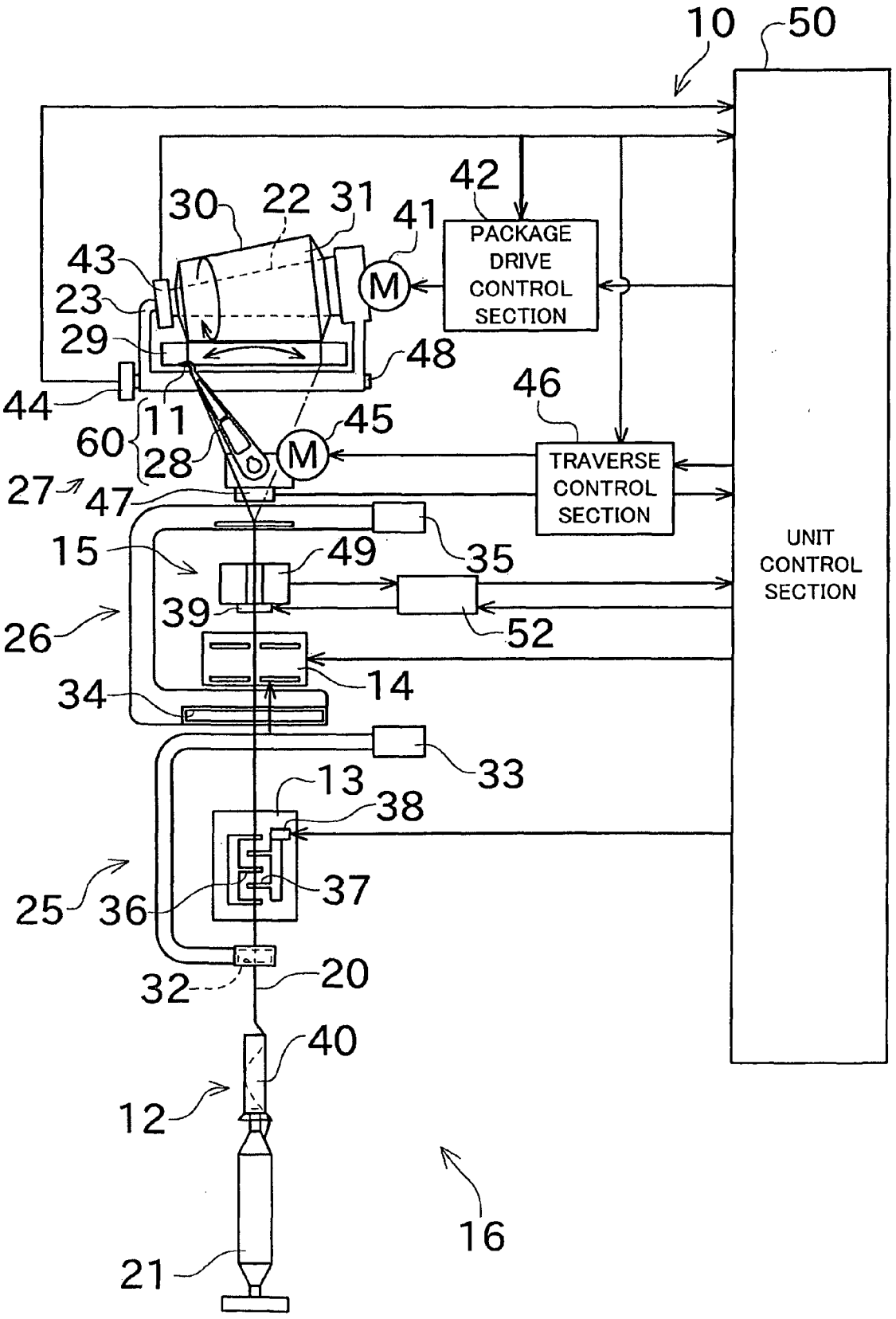

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FIG. 2

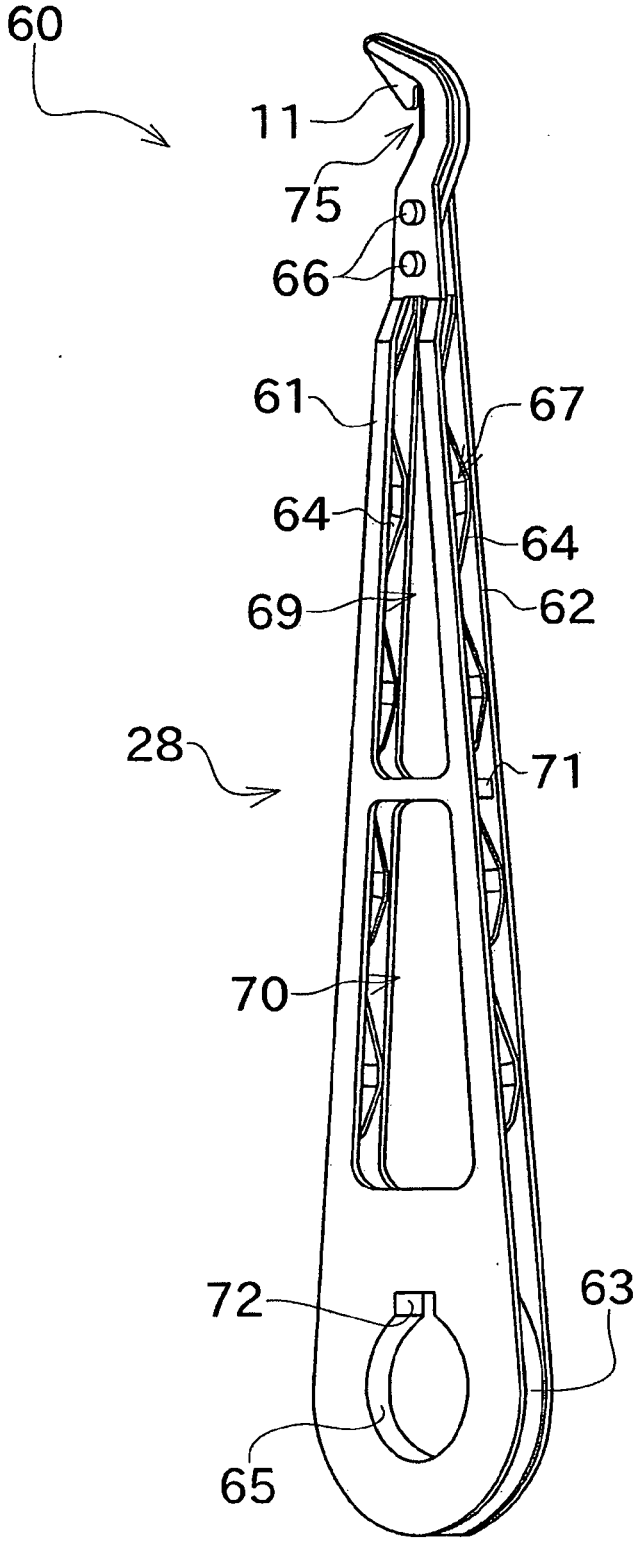


FIG. 3

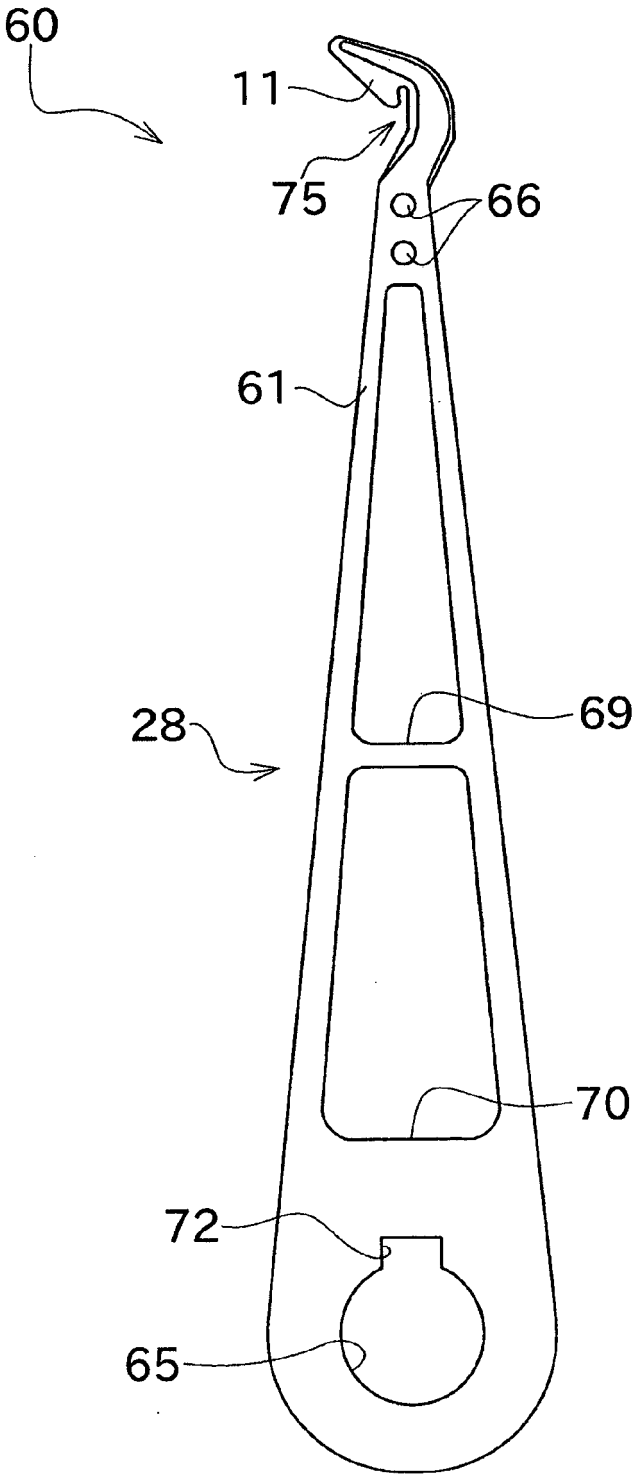


FIG. 4

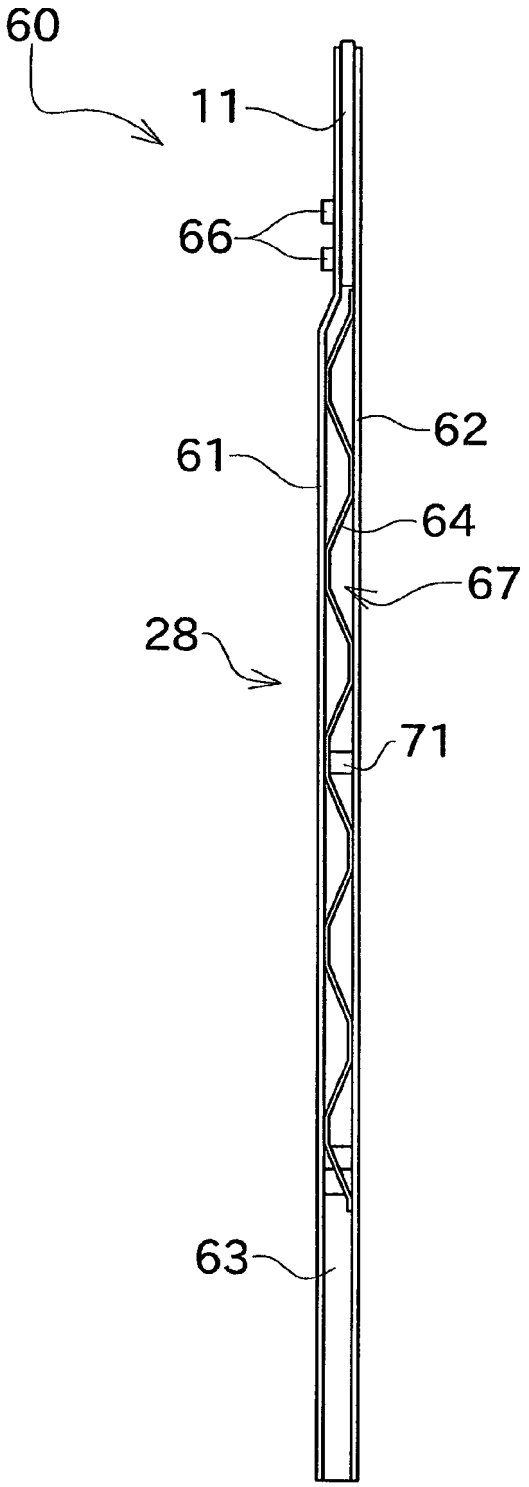
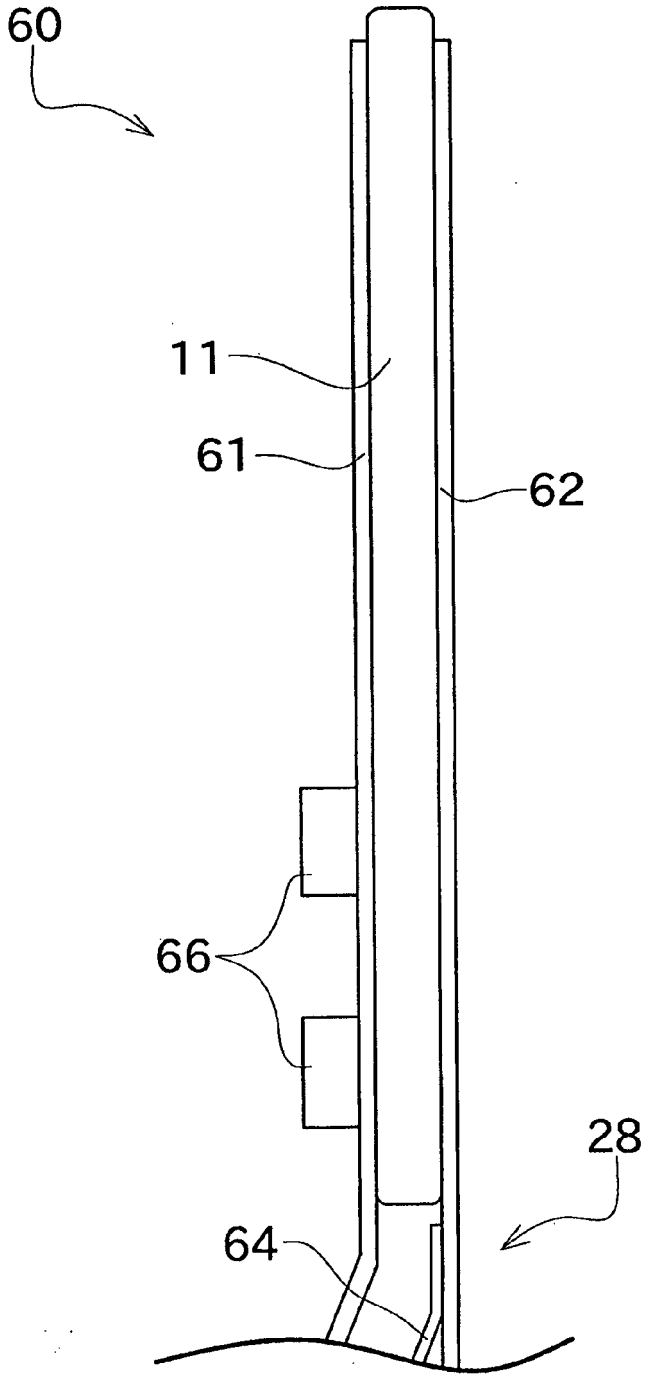


FIG. 5



REFERENCES CITED IN THE DESCRIPTION

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