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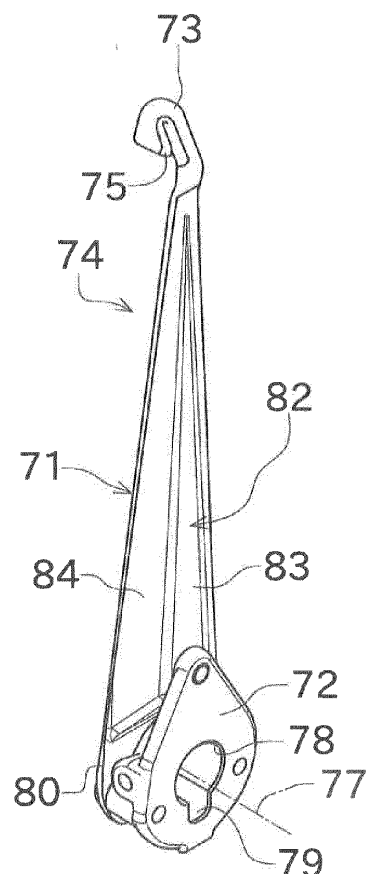
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(54) **Traverse arm and yarn winding machine including the same**

(57) A traverse arm (74) includes an arm body (71) and a traverse guide (73) arranged at a tip-end portion of the arm body (71), and is adapted to be driven and swung by a swing-drive shaft (77) substantially perpendicular to a longitudinal direction of the arm body (71). The arm body (71) is made of a plate member, and at least a portion of the plate member is bent within a cross section perpendicular to the longitudinal direction to form a protrusion (82) that protrudes in a direction of the swing-drive shaft.

FIG. 4C



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a traverse arm for traversing a yarn in a yarn winding machine.

2. Description of the Related Art

[0002] The yarn winding machine includes a traverse device for traversing a yarn to be wound around a winding bobbin. As such a traverse device, there is conventionally known an arm-type traverse device including a traverse arm adapted to be driven and swung. Such a traverse device is described in Japanese Unexamined Patent Application Publication No. 2011-195217 (Patent Document 1) and Japanese Unexamined Patent Application Publication No. 2010-137944 (Patent Document 2).

[0003] Since the traverse arm is driven and swung at a high speed, the traverse arm preferably has an utmost possible lightweight property. On the other hand, the traverse arm requires strength such that in a where force from a caught yarn or the like is applied, the traverse arm is not broken or bent.

[0004] In this respect, Patent Document 2 discloses a traverse arm having a truss structure in which a beam is sandwiched between two plates. According to Patent Document 2, employing the truss structure in the traverse arm allows reducing weight of the traverse arm and enhancing stiffness thereof.

SUMMARY OF THE INVENTION

[0005] The object of the present invention is to provide a light traverse arm superior in strength property and manufacturable at low cost, and a yarn winding machine including same.

This object is achieved by a traverse arm according to claim 1, and by a yarn winding machine according to claim 9.

[0006] The traverse arm having the truss structure disclosed in Patent Document 2 has a complicated structure in which the two plates and the beam are pasted together. Therefore, there is a problem in which manufacturing cost is high, and manufacturing is difficult.

[0007] According to an aspect of the present invention, a traverse arm includes an arm body and a traverse guide arranged at a tip-end portion of the arm body in a longitudinal direction of the arm body, and is driven and swung about a swing-drive shaft arranged substantially perpendicular to the longitudinal direction of the arm body. The arm body is made of a plate member, and at least a portion of the plate member is bent within a cross section perpendicular to the longitudinal direction to form a protrusion that protrudes in a same direction as the swing-drive shaft.

[0008] Since the arm body is made of the plate member, a configuration of a thin arm body is possible, thereby allowing reduction in weight of the arm body. Forming the protrusion in the arm body by bending the plate member within a plane perpendicular to the longitudinal direction ensures stiffness of the arm body in a simple configuration. For bending the plate member, a press machine can be used, e.g., thereby allowing facilitation of manufacture.

[0009] It is preferable that in the traverse arm, the protrusion of the arm body is formed such that a protrusion amount of the protrusion in the same direction as the swing-drive shaft is larger at a portion located away from the tip-end portion in the longitudinal direction than at the tip-end portion.

[0010] More stiffness is required in a portion of the traverse arm as the portion is located away from the tip-end portion. By forming the traverse arm in an above-described manner, the stiffness of the traverse arm is enhanced at the portion located away from the tip-end portion.

[0011] In the traverse arm, it is preferable that the protrusion is formed by the plate member being bent in a polygonal line at an obtuse angle.

[0012] The plate member is bent at an obtuse angle to form the protrusion. In comparison with a case of bending the plate member at a right angle, e.g., the plate member can be easily bent by the press machine or the like.

[0013] The traverse arm preferably includes a mounting member. The mounting member is provided separately from the arm body, and the mounting member to be mounted to the swing-drive shaft is fixed to a base-end portion of the arm body in the longitudinal direction of the arm body.

[0014] Since torque for driving and swinging the traverse arm is applied on a base-end portion of the traverse arm, the base-end portion of the traverse arm especially requires stiffness. Thus, by fixing the mounting member having adequate stiffness to the base-end portion of the arm body in the above-described manner, the stiffness at the base-end portion of the traverse arm can be ensured.

[0015] The arm body of the traverse arm includes at the base-end portion in the longitudinal direction, a flat-plate portion substantially perpendicular to the swing-drive shaft. The mounting member is fixed to at least the flat-plate portion.

[0016] Since the flat-plate portion is arranged at the base-end portion of the arm body and the mounting member is mounted to the flat-plate portion, the mounting member can be stably fixed to the base-end portion of the arm body.

[0017] In the traverse arm, it is preferable that the mounting member is arranged over the flat-plate portion and the protrusion, and is fixed to each of the flat-plate portion and the protrusion.

[0018] By arranging the mounting member over the protrusion and the flat-plate portion, the mounting mem-

ber can be more stably fixed to the arm body.

[0019] In the traverse arm, a through hole is preferably formed through the arm body so as to receive a fixing member. The mounting member is fixed to the arm body by the fixing member.

[0020] By mounting the fixing member to the mounting member via the through hole formed through the arm body, the arm body and the mounting body can be firmly fastened to each other. The through hole for passing through the fixing member can be formed through the arm body by the press machine or the like.

[0021] According to another aspect of the present invention, a yarn winding machine includes a plurality of winding units. Each of the winding units includes a traverse device adapted to traverse a yarn by the above-described traverse arm.

[0022] Since the yarn winding machine includes the traverse arm of the present invention, which is light, superior in stiffness property, and manufacturable at low cost, the yarn to be wound can be stably traversed, and in addition, costs can be reduced. Thus, according to the yarn winding machine of the present invention, a package having high quality can be formed at low cost.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

FIG. 1 is a front view of an automatic winder according to one embodiment of the present invention;
 FIG. 2 is a schematic front view of a winder unit;
 FIG. 3 is a side view illustrating proximity of 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 front view of an arm body;
 FIG. 6 is a cross sectional view taken along arrows A-A of FIG. 5; and
 FIG. 7 is a cross sectional view taken along arrows B-B of FIG. 5, and a cross sectional view taken along arrows C-C of FIG. 5.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0024] Next, an embodiment of the present invention will be described. Firstly, a configuration of an automatic winder (yarn winding machine) 1 of the present embodiment will be described with reference to FIGS. 1 to 3. "Upstream" and "downstream" in the present specification respectively indicate upstream and downstream in a travelling direction of a yarn at the time of yarn winding.

[0025] As illustrated in FIG. 1, the automatic winder (yarn winding machine) 1 includes a plurality of winder units (winding units) 10 arranged next to each other.

[0026] As illustrated in FIG. 2, each of the winder units 10 includes a yarn supplying section 11, a yarn unwinding

assisting device 12, a tension applying device 13, a splicer device (yarn joining device) 14, a clearer (yarn defect detecting device) 15, and a winding section 16. The winder unit 10 includes a unit control section 50 adapted to control an operation of each of the sections provided in the winder unit 10.

[0027] The yarn supplying section 11 holds in a predetermined position, the yarn supplying bobbin 21 adapted to supply a yarn 20.

[0028] The yarn unwinding assisting device 12 includes a regulating member 40 covering a core tube of the yarn supplying bobbin 21. The regulating member 40 makes contact with a portion (balloon), which is swung around the yarn supplying bobbin 21 by centrifugal force, of the yarn 20 having been unwound from the yarn supplying bobbin 21. In this manner, the yarn unwinding assisting device 12 controls the balloon such that a size of the balloon is appropriate, and assists unwinding of the yarn 20 from the yarn supplying bobbin 21.

[0029] The tension applying device 13 applies a predetermined tension on the travelling yarn 20. The tension applying device 13 may be, e.g., a gate type in which movable comb teeth are arranged with respect to fixed comb teeth. Since the yarn 20 bends and passes through between the engaged comb teeth, resistance is applied on the travelling yarn 20 and thereby allowing an appropriate tension to be applied on the yarn 20. Other than the gate type, a disc type, e.g., may be employed as the tension applying device 13.

[0030] The clearer 15 includes a sensor, which is not illustrated, for detecting an abnormal portion of the yarn 20 (yarn defect). Provided in proximity to the clearer 15 is a cutter 39 for immediately cutting the yarn 20 when the clearer 15 detects the yarn defect.

[0031] The splicer device 14 joins a lower yarn from the yarn supplying bobbin 21 and an upper yarn from a winding bobbin 22 at the time of a yarn cutting performed after the clearer 15 detects the yarn defect, a yarn breakage during the unwinding from the yarn supplying bobbin 21, or the like. A yarn joining device adapted to perform yarn joining of the upper yarn and the lower yarn in such a manner may be a mechanical type, a type of using fluid such as compressed air, or the like.

[0032] A lower yarn catching member 25 for catching a yarn end from the yarn supplying bobbin 21 and guiding the yarn end to the splicer device 14 is arranged in a part below the splicer device 14. An upper yarn catching member 26 for catching a yarn end from the winding bobbin 22 and guiding the yarn end to the splicer device 14 is arranged in a part above the splicer device 14.

[0033] The winding section 16 includes a cradle 23 adapted to support the winding bobbin 22 for winding the yarn 20, and a contact roller 29 capable of rotating by being in contact with a peripheral surface of the winding bobbin 22. The winding section 16 includes a rotary drive source, which is not illustrated, for driving and rotating the winding bobbin 22 supported by the cradle 23. By driving and rotating the winding bobbin 22, the yarn 20

can be wound around an outer periphery of the winding bobbin 22. The winding bobbin 22 around which the yarn 20 is wound is referred to as a package 30.

[0034] The winder unit 10 includes an arm type traverse device 70 adapted to traverse the yarn 20 to be wound around the winding bobbin 22. The traverse device 70 is arranged in proximity to the cradle 23. As illustrated in FIG. 3, the traverse device 70 includes a traverse drive motor 76, a swing-drive shaft 77, and a traverse arm 74.

[0035] The traverse drive motor 76 is adapted to drive and swing the traverse arm 74 and is constituted of a servomotor or the like. An output shaft of the traverse drive motor 76 is the swing-drive shaft 77. As illustrated in FIG. 3, the swing-drive shaft 77 is connected to a base-end portion of the traverse arm 74 in a longitudinal direction of the traverse arm 74. The traverse arm 74 is fixed to the swing-drive shaft 77 in a relatively non-rotatable manner. As illustrated in FIG. 3, in a state where the traverse arm 74 is fixed to the swing-drive shaft 77, the longitudinal direction of the traverse arm 74 and the swing-drive shaft 77 are substantially perpendicular to each other.

[0036] A traverse guide 73 is formed at a tip-end portion of the traverse arm 74 (an end portion opposite to the base-end portion in the longitudinal direction). The traverse guide 73 is formed into a shape by which the traverse guide 73 can be engaged with the yarn 20 to be wound around the winding bobbin 22 (a shape by which the traverse guide 73 can hook the yarn 20).

[0037] Since a rotor of the traverse drive motor 76 repeats forward/reverse rotations and thereby swings the traverse arm 74, the traverse guide 73 reciprocates with respect to a direction of a winding width of the package 30 (a left-right direction in FIG. 2, a perpendicular direction in the plane of FIG. 3). By rotating the winding bobbin 22 in a state where the traverse guide 73 is engaged with the yarn 20, the yarn 20 is wound around the winding bobbin 22 while being traversed, thereby a predetermined-shaped package 30 can be formed.

[0038] Next, the traverse arm 74 according to the present embodiment will be described with reference to FIGS. 4A to 4C.

[0039] As illustrated in FIGS. 4A to 4C, the traverse arm 74 of the present embodiment includes an arm body 71, a guide member 75, and a mounting member, 72.

[0040] As illustrated in FIGS. 4A to 4C, the arm body 71 is formed into an elongated shape. In a longitudinal direction of the arm body 71, a side where the swing-drive shaft 77 is mounted and a side opposite thereof (a side of the traverse guide 73) are respectively referred to as a "base-end" and a "tip-end". In the following description, the longitudinal direction of the arm body 71 may be simply referred to as a "longitudinal direction". Furthermore, in the following description, a direction parallel to an axial line of the swing-drive shaft 77 is referred to as a "swing-drive shaft direction". The swing-drive shaft direction is perpendicular to the longitudinal direc-

tion of the arm body 71. A direction perpendicular to the longitudinal direction and the swing-drive shaft direction (a left-right direction in FIG. 4B) is referred to as a "traverse width direction".

[0041] The arm body 71 is made of a processed plate member. Since the arm body 71 is made of the plate member, configuration of the thin arm body 71 is possible, thereby allowing reduction in weight of the arm body 71.

[0042] Specifically, the arm body 71 of the present embodiment is made of a pressed aluminum plate. Since the arm body 71 is made of the aluminum plate, the configuration of the thin arm body 71 is possible and appropriate stiffness can be ensured. Since the arm body 71 is made by a press machine, the arm body 71 is easily produced in a large quantity.

[0043] As illustrated in FIGS. 4A to 4C, the traverse guide 73 is formed at the tip-end portion of the arm body 71. As described above, the traverse guide 73 is formed into the shape by which the traverse guide 73 can be engaged with the yarn 20. The traverse guide 73 of the present embodiment is formed into a hook shape as illustrated in FIG. 4B.

[0044] The guide member 75 is arranged in a portion of the traverse guide 73 where the traverse guide 73 makes contact with the yarn 20 (in the present embodiment, an inner portion of the hook-shaped traverse guide 73). The guide member 75 is made of a material superior in abrasion resistance such as ceramics, and is fixed to the arm body 71. The yarn 20 to be traversed by the traverse device 70 travels while making contact with the guide member 75.

[0045] When the traverse arm 74 is driven and swung, a large amount of torque is applied between the traverse arm 74 and the swing-drive shaft 77. A portion of the traverse arm 74 to which the swing-drive shaft 77 is mounted thus requires adequate stiffness. Since the arm body 71 of the present embodiment is made of the aluminum plate, it is difficult to provide a base-end portion of the arm body 71 with stiffness that allows the swing-drive shaft 77 to be directly attached thereto.

[0046] The mounting member 72 for mounting the swing-drive shaft 77 is arranged at the base-end portion of the traverse arm 74 of the present embodiment. A mounting hole 78 for mounting the swing-drive shaft 77 is formed in the mounting member 72. A key groove 79 for preventing the traverse arm 74 from relatively rotating with respect to the swing-drive shaft 77 is formed in the mounting hole 78.

[0047] In the traverse arm 74 of the present embodiment, the mounting member 72 is provided separately from the arm body 71. Since the mounting member 72 is provided separately from the arm body 71, the mounting member 72 can be formed by a manufacturing method (e.g., using a cutting machine) other than using the press machine. The mounting member 72 thus can be formed into any shape that ensures adequate stiffness. In the present embodiment, the mounting member 72 is made of aluminum.

[0048] Next, a configuration of the arm body 71 will be described in detail with reference to FIGS. 5 to 7.

[0049] As described above, the hook-shaped traverse guide 73 is formed at the tip end of the arm body 71. As illustrated in FIG. 5, a flat-plate portion 80 for fixing the mounting member 72 is formed at the base end of the arm body 71. In the following description, a portion of the arm body 71 between the traverse guide 73 and the flat-plate portion 80 is referred to as an intermediate portion 85.

[0050] In the arm body 71 of the present embodiment, the traverse guide 73, the intermediate portion 85 and the flat-plate portion 80 are formed by processing one piece of aluminum plate by the press machine. The traverse guide 73, the intermediate portion 85, and the flat-plate portion are formed as one body.

[0051] As illustrated in FIG. 6, the flat-plate portion 80 is formed as a flat plate perpendicular to the swing-drive shaft 77. Since the flat-plate portion 80 is formed as the flat plate perpendicular to the swing-drive shaft 77, the mounting member 72 can be stably mounted to the flat-plate portion 80.

[0052] As illustrated in FIG. 6, the arm body 71 is bent in a boundary portion between the traverse guide 73 and the intermediate portion 85 when viewed in the traverse width direction. The arm body 71 is bent in such a manner for positioning the traverse guide 73 to be closer to an outer periphery of the contact roller 29 as illustrated in FIG. 3. The bending in the boundary portion between the traverse guide 73 and the intermediate portion 85 can be formed using the press machine.

[0053] As illustrated in FIG. 5, a contour shape of the intermediate portion 85 of the arm body 71 is formed so as to become gradually thicker from the tip-end portion towards the base-end portion when viewed in the swing-drive shaft direction. This causes stiffness in a portion of the arm body 71 to be higher as the portion is located close to the base-end portion within a plane perpendicular to the swing-drive shaft 77 (within a plane illustrated in FIG. 5). Therefore, e.g., even if the yarn 20 is caught in the traverse guide 73 and thereby causes force on the traverse arm 74, the arm body 71 is not likely to change its shape within the plane perpendicular to the swing-drive shaft 77.

[0054] As illustrated in FIG. 7, a protrusion 82 that protrudes towards one side in the swing-drive shaft direction within a cross section perpendicular to the longitudinal direction (within a cross section illustrated in FIG. 7) is formed in the intermediating portion 85 of the arm body 71 of the present embodiment. When viewing the protrusion 82 from the back, it can be said that a recess that recesses towards one side in the swing-drive shaft direction is formed. Since the protrusion and the recess are inextricably linked together, the relevant portion will be described as the protrusion 82 in the following description.

[0055] For example, the protrusion 82 is formed by drawing or bending by the press machine. Forming the

protrusion 82 in the arm body 71 allows enhancement in the stiffness of the arm body 71 within a plane including the swing-drive shaft direction and the longitudinal direction (within a plane illustrated in FIG. 6).

[0056] As illustrated in cross sectional views of FIG. 6 and FIG. 7, the protrusion 82 is formed such that a protrusion amount of the protrusion 82 gradually becomes larger from the tip-end portion towards the base-end portion. This causes the stiffness in a portion of the arm body 71 to be higher as the portion is located close to the base-end portion within the plane including the swing-drive shaft direction and the longitudinal direction (within the plane illustrated in FIG. 6). In other words, the protrusion 82 of the arm body 71 is formed such that a protrusion amount of the protrusion 82 in the same direction as the swing-drive shaft 77 is larger at a portion of the arm body 71 (e.g. the base-end portion) located away from the tip-end portion in the longitudinal direction than at a portion of the arm body 71 located close to the tip-end portion in the longitudinal direction.

[0057] With the above-described configuration, e.g., even if the yarn 20 is caught in the traverse guide 73 and thereby causes force on the traverse arm 74, the arm body 71 is not likely to change its shape within the plane including the swing-drive shaft direction and the longitudinal direction (within the plane illustrated in FIG. 6).

[0058] Next, a configuration of the protrusion 82 will be described more specifically.

[0059] As illustrated in FIG. 7, the protrusion 82 is formed by bending the plate member (an aluminum plate in the present embodiment) of the arm body 71 within the cross section perpendicular to the longitudinal direction. In the present embodiment, as illustrated in FIG. 7, the protrusion 82 is formed by the aluminum plate being bent in a polygonal line within the cross section perpendicular to the longitudinal direction.

[0060] As illustrated in a perspective view of FIG. 4C and the like, the protrusion 82 is formed by connecting planes to one another, each plane facing in a different direction. Specifically, as illustrated in FIG. 5, FIG. 7, and the like, the arm body 71 includes a front portion 83 and a side portion 84.

[0061] As illustrated in FIG. 5 and FIG. 4C, each of the front portion 83 and the side portion 84 is formed as a triangular plane of which the width widens from the tip-end portion towards the base-end portion.

[0062] The front portion 83 is formed such that a normal line of the front portion 83 is in the swing-drive shaft direction (that is, the front portion 83 faces in the swing-drive shaft direction). The side portion 84 is connected to each of both end portions of the front portion 83 in the traverse width direction. As illustrated in FIG. 7, the side portion 84 is connected diagonally with respect to the front portion 83 within the cross section perpendicular to the longitudinal direction. Therefore, a normal line of the side portion 84 faces in a direction diagonal with respect to the swing-drive shaft direction.

[0063] As illustrated in FIG. 7, the front portion 83 and

the side portion 84 are connected to each other at an obtuse angle within the cross section perpendicular to the longitudinal direction. The aluminum plate of the arm body 71 is bent at an obtuse angle within the cross section. Since an angle at which the aluminum plate is bent is obtuse, the protrusion 82 is easily formed by bending the aluminum plate by the press machine.

[0064] As illustrated in FIG. 5 and FIG. 6, the arm body 71 of the present embodiment includes a planar bottom portion 86 for connecting a side of the front portion 83 on a base-end portion side to the flat-plate portion 80. As illustrated in FIG. 5, the bottom portion 86 is formed into a trapezoidal shape and is connected to each side of the front portion 83 and the side portion 84 on the base-end portion side.

[0065] As illustrated in FIG. 6, the flat-plate portion 80 and the front portion 83 are arranged substantially parallel to each other. A step 87 is formed between the front portion 83 and the flat-plate portion 80 in the swing-drive shaft direction.

[0066] A structure for mounting the mounting member 72 to the arm body 71 will be described in detail.

[0067] As illustrated in FIG. 5, a through hole 81 for inserting a screw (fixing member) is formed through the flat-plate portion 80. By screwing a fixing screw into the mounting member 72 via the through hole 81, the mounting member 72 can be fixed to the flat-plate portion 80. A forming method of the through hole 81 is not particularly limited. In the present embodiment, the through hole 81 is formed by punching out the plate member using the press machine. This allows simultaneous formation of the through hole 81 when forming the arm body 71 by the press machine.

[0068] In the flat-plate portion 80 of the present embodiment, two through holes 81 are formed side by side in the traverse width direction. When fixing the mounting member 72 to the flat-plate portion 80, screws are threaded into each of the two through holes 81 and are screwed into the mounting member 72. By screwing the mounting member 72 via a plurality of the through holes formed through the arm body 71, the mounting member 72 can be stably fixed to the arm body 71.

[0069] In the present embodiment, as illustrated in FIG. 5 and FIG. 6, a through hole 88 is also formed at the base end of the protrusion 82 (specifically, at a base end of the front portion 83). As illustrated in FIGS. 4A to 4C, the mounting member 72 is arranged over the protrusion 82 and the flat-plate portion 80. When fixing the mounting member 72 to the arm body 71, a screw is threaded into the through hole 88 formed through the protrusion 82 and is screwed into the mounting member 72. Accordingly, since the mounting member 72 can be fixed to both of the protrusion 82 and the flat-plate portion 80, the mounting member 72 can be stably fixed to the arm body 71.

[0070] Furthermore, in the present embodiment, as illustrated in FIG. 5, the through hole 88 formed through the protrusion 82 and the two through holes 81 formed through the flat-plate portion 80 constitute vertices of a

triangle when viewed in the swing-drive shaft direction. The mounting member 72 of the present embodiment is screwed to the arm body 71 at three points when viewed in the swing-drive shaft direction. Accordingly, the mounting member 72 can be more stably fixed to the arm body 71 within the plane perpendicular to the swing-drive shaft direction (within the plane illustrated in FIG. 5).

[0071] As described above, the traverse arm 74 of the present embodiment includes the arm body 71 and the traverse guide 73 arranged at the tip-end portion of the arm body 71 in the longitudinal direction, and is driven and swung about the swing-drive shaft 77 arranged substantially perpendicular to the longitudinal direction of the arm body 71. The arm body 71 is made of the plate member, and a portion of the plate member is bent within the cross section perpendicular to the longitudinal direction (within the cross section illustrated in FIG. 7) to form the protrusion 82 that protrudes in the swing-drive shaft direction.

[0072] Since the arm body 71 is made of the plate member, the configuration of the thin arm body 71 is possible, thereby allowing reduction in the weight of arm body 71. Forming the protrusion 82 in the arm body 71 by bending the plate member within the plane perpendicular to the longitudinal direction ensures the stiffness of the arm body 71 in a simple configuration. A press machine or the like can be used for bending the plate member, thereby allowing facilitation of manufacture.

[0073] In the traverse arm 74 of the present embodiment, the protrusion 82 of the arm body 71 is formed such that the protrusion amount of the protrusion 82 is larger at a portion located away from the tip-end portion in the longitudinal direction than at the tip-end portion.

[0074] Since more stiffness is required in a portion of the traverse arm 74 as the portion is located away from the tip-end portion, by forming in the above-described manner, the stiffness of the traverse arm 74 can be gradually enhanced in a direction away from the tip-end portion.

[0075] In the traverse arm 74 of the present embodiment, the aluminum plate of the arm body 71 is bent in a polygonal line at an obtuse angle within the plane perpendicular to the longitudinal direction.

[0076] The aluminum plate is bent at an obtuse angle to form the protrusion 82. In comparison with a case in which the aluminum plate is bent at a right angle, the plate member can be easily bent by the press machine or the like.

[0077] The traverse arm 74 of the present embodiment includes the mounting member 72. The mounting member 72 is provided separately from the arm body 71, and is mounted to the swing-drive shaft 77. The mounting member 72 is fixed to the base-end portion of the arm body 71 in the longitudinal direction.

[0078] Since the torque for driving and swinging the traverse arm 74 is applied on the base-end portion of the traverse arm 74, the base-end portion of the traverse arm 74 especially requires stiffness. By fixing the mounting

member 72 having adequate stiffness to the base-end portion of the arm body 71 in the above-described manner, stiffness at the base-end portion of the traverse arm 74 can be ensured.

[0079] In the traverse arm 74 of the present embodiment, the arm body 71 includes at the base-end portion in the longitudinal direction, the flat-plate portion 80 substantially perpendicular to the swing-drive shaft 77. The mounting member 72 is fixed to the flat-plate portion 80.

[0080] Since the flat-plate portion 80 is arranged at the base-end portion of the arm body 71 and the mounting member 72 is mounted to the flat-plate portion 80, the mounting member 72 can be stably fixed to the base-end portion of the arm body 71.

[0081] In the traverse arm 74 of the present embodiment, the mounting member 72 is arranged over the flat-plate portion 80 and the protrusion 82, and is fixed to each of the flat-plate portion 80 and the protrusion 82.

[0082] By arranging the mounting member 72 over the protrusion 82 and the flat-plate portion 80, the mounting member 72 can be more stably fixed to the arm body 71.

[0083] In the traverse arm 74 of the present embodiment, the through holes 81 and 88 are formed through the arm body 71 so as to pass through screws. The mounting member 72 is fixed to the arm body 71 by fastening the screws via the through holes 81 and 88.

[0084] By screwing the screws into the mounting member 72 via the through holes 81 and 88 formed through the arm body 71, the arm body 71 and the mounting member 72 can be firmly fastened to each other. The through holes 81 and 88 for passing through the screws can be formed through the arm body 71 by the press machine or the like.

[0085] The automatic winder 1 of the present embodiment includes the plurality of winder units 10. Each of the winder units 10 includes the traverse device 70 adapted to traverse the yarn 20 by the traverse arm 74.

[0086] Since the automatic winder 1 includes the light traverse arm 74 superior in stiffness property and manufacturable at low cost, the yarn 20 to be wound can be stably traversed, and in addition, costs can be reduced. Thus, with the automatic winder 1 of the present embodiment, the package 30 having high quality can be formed at low cost.

[0087] Although a preferred embodiment of the present invention has been described, the configuration may be changed, e.g., as described below.

[0088] Although the arm body 71 is formed by pressing an aluminum plate, without limited thereto, the arm body 71 may be made of an appropriate metal plate. As a material for the arm body 71, a light material having adequate stiffness property is preferable.

[0089] The material for the arm body 71 is not limited to a metal plate, and the arm body 71 may be formed by appropriately bending another plate member. An arm body of which shape is equivalent to the arm body 71 of the above-described embodiment can be formed with a material such as a CFRP (Carbon Fiber Reinforced Plas-

tics) plate.

[0090] A hole for reducing weight may be appropriately formed through the arm body 71.

[0091] In the above-described embodiment, the arm body 71 is bent in a polygonal line within the plane perpendicular to the longitudinal direction to form the protrusion 82. In this case, as illustrated in the perspective view of FIG. 4C, the protrusion 82 has a polyhedral shape. Without limited thereto, the protrusion 82 may be formed by, e.g., bending the arm body 71 in a curved line within the plane perpendicular to the longitudinal direction. In this case, the protrusion 82 is curved. The point is that the protrusion 82 (or the recess) merely requires to be formed by bending the arm body 71 within the plane perpendicular to the longitudinal direction, and its shape is not particularly limited.

[0092] At least one protrusion is required to be formed in the arm body 71, and a plurality of the protrusions may be formed.

[0093] In the above-described embodiment, the material of the mounting member 72 is aluminum. However, the material of the mounting member 72 is not limited to the aluminum, and is merely required to have a certain degree of stiffness. The material of the mounting member 72 and the material of the arm body 71 may be different.

[0094] The structure for mounting the mounting member 72 to the arm body 71 is not limited to the above-described structure, and an appropriate structure may be employed. The mounting member 72 may be omitted and the arm body 71 may be directly mounted to the swing-drive shaft 77.

[0095] The fixing member for fixing the mounting member 72 to the arm body 71 is not limited to a screw, and may be, e.g., a caulking pin.

Claims

1. A traverse arm comprising;
an arm body (71); and
a traverse guide (73) arranged at a tip-end portion of the arm body (71) in a longitudinal direction of the arm body (71),
the traverse arm adapted to be driven and swung about a swing-drive shaft (77) arranged substantially perpendicular to the longitudinal direction of the arm body (71),
wherein the arm body (71) is made of a plate member, and at least a portion of the plate member is bent within a cross section perpendicular to the longitudinal direction to form a protrusion (82) that protrudes in a same direction as the swing-drive shaft (77).
2. The traverse arm according to claim 1, wherein the protrusion (82) of the arm body (71) is formed such that a protrusion amount of the protrusion (82) in the same direction as the swing-drive shaft (77) is larger

at a portion of the arm body (71) located away from the tip-end portion in the longitudinal direction than at a portion of the arm body (71) located close to the tip-end portion in the longitudinal direction.

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3. The traverse arm according to claim 1 or claim 2, wherein the protrusion (82) is formed by the plate member being bent in a polygonal line at an obtuse angle.

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4. The traverse arm according to any one of claim 1 through claim 3, further comprising a mounting member (72) provided separately from the arm body (71) and adapted to be mounted to the swing-drive shaft (77), wherein the mounting member (72) is fixed to a base-end portion of the arm body (71) in the longitudinal direction of the arm body (71).

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5. The traverse arm according to claim 4, wherein the arm body (71) includes a flat-plate portion (80) at the base-end portion in the longitudinal direction, the flat-plate portion (80) being substantially perpendicular to the swing-drive shaft (77), and the mounting member (72) is fixed to at least the flat-plate portion (80).

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6. The traverse arm according to claim 5, wherein the mounting member (72) is arranged over the flat-plate portion (80) and the protrusion (82), and is fixed to each of the flat-plate portion (80) and the protrusion (82).

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7. The traverse arm according to claim 5 or claim 6, wherein a through hole (81) is formed through the arm body (71), the through hole (81) being adapted to receive a fixing member, and the mounting member (72) is fixed to the arm body (71) by the fixing member.

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8. The traverse arm according to any one of claim 1 through claim 7, wherein the arm body (71) is a pressed metal plate.

9. A yarn winding machine comprising a plurality of winding units (10), each winding unit (10) including a traverse device (70) adapted to traverse a yarn (20) by a traverse arm (74) according to any one of claim 1 through claim 8.

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FIG. 1

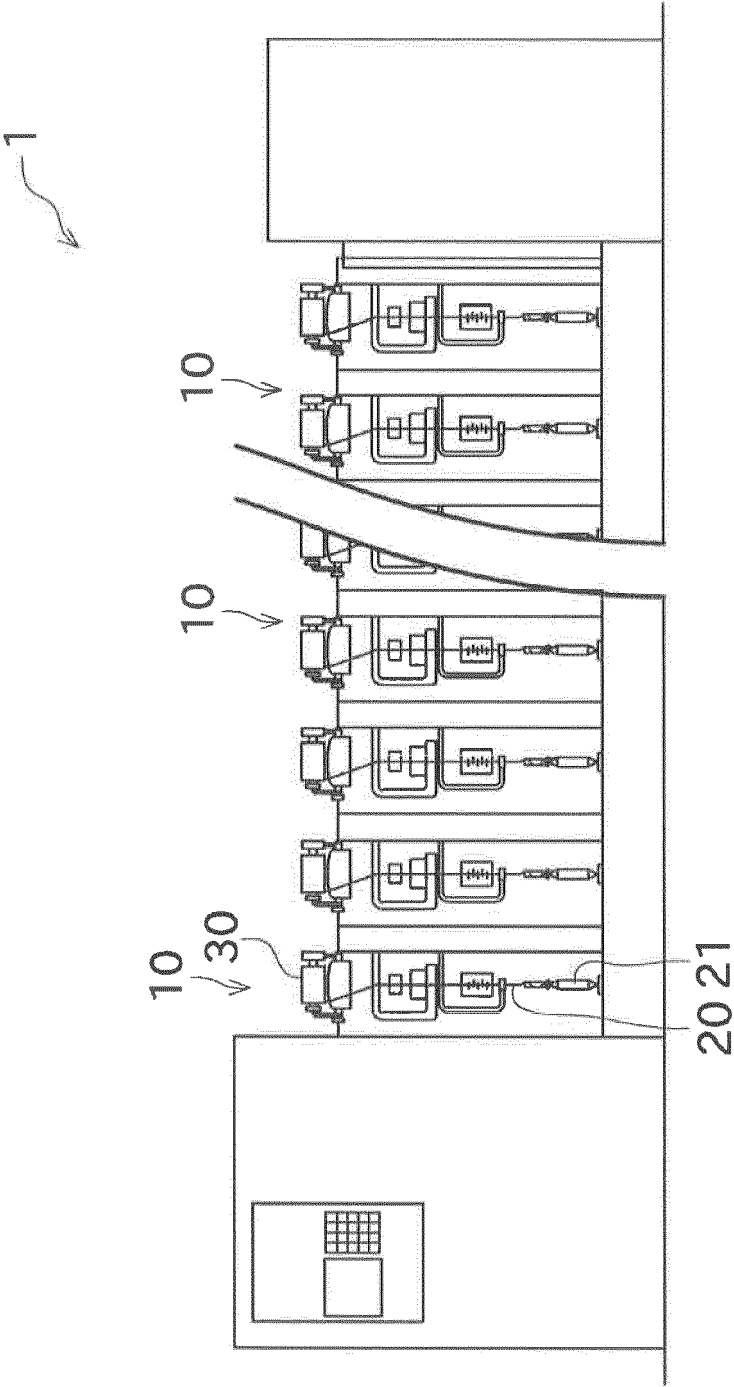


FIG. 2

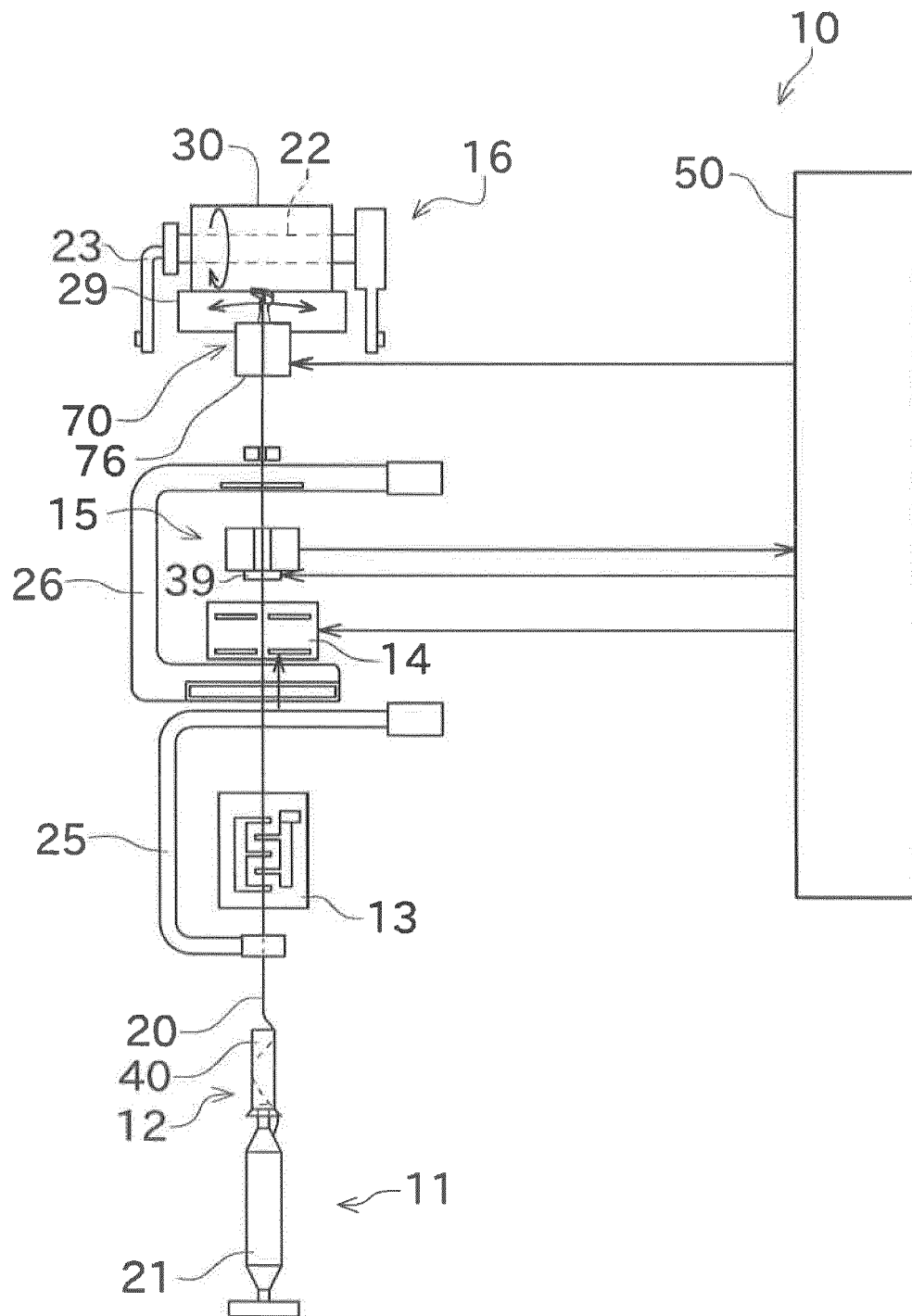


FIG. 3

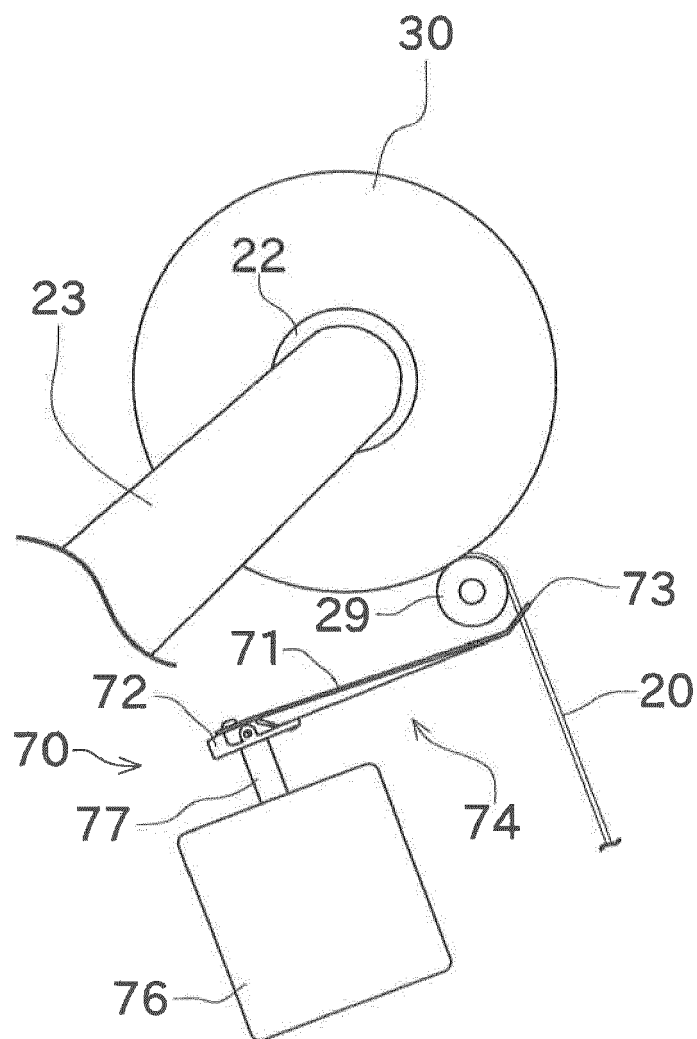


FIG. 4A FIG. 4B FIG. 4C

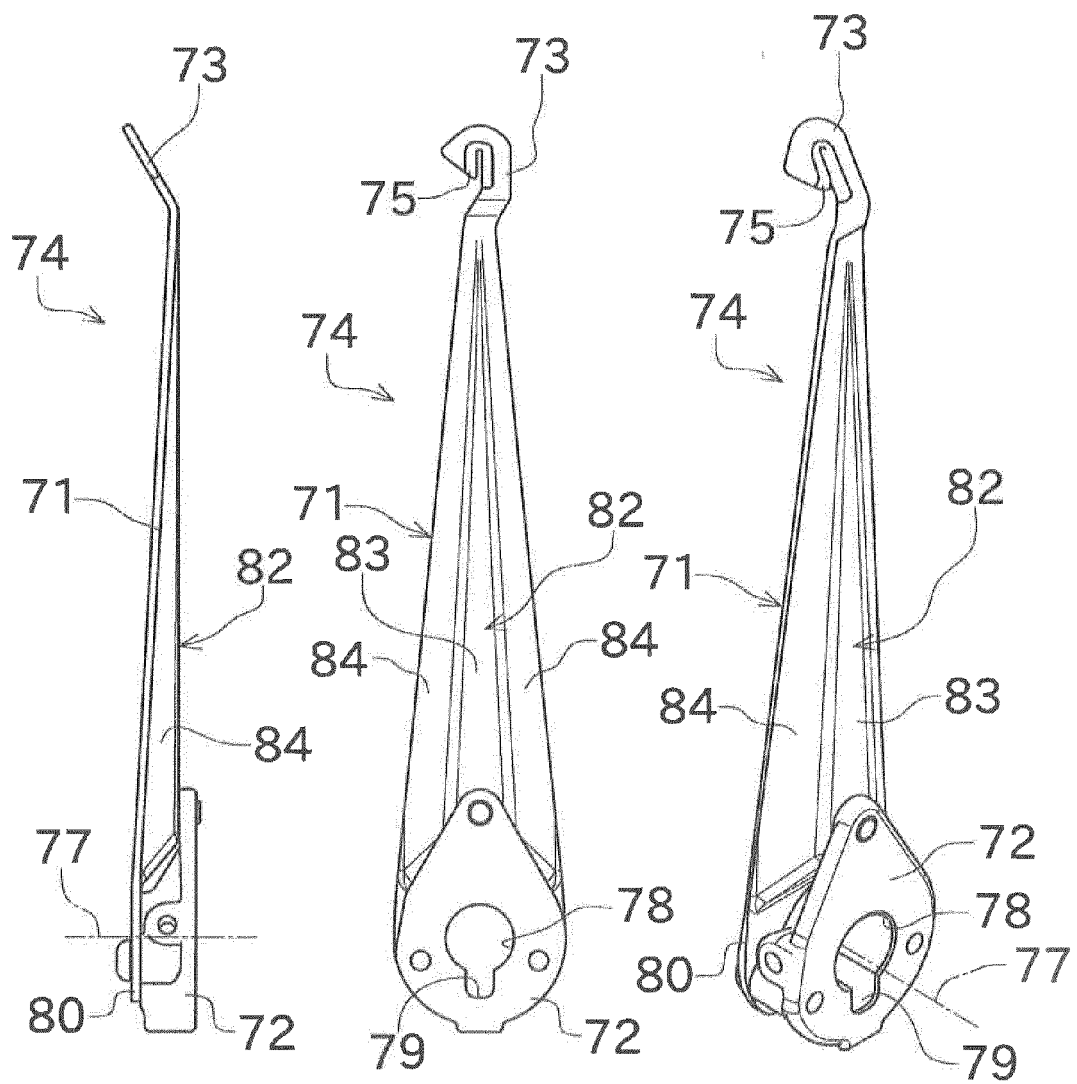


FIG. 5

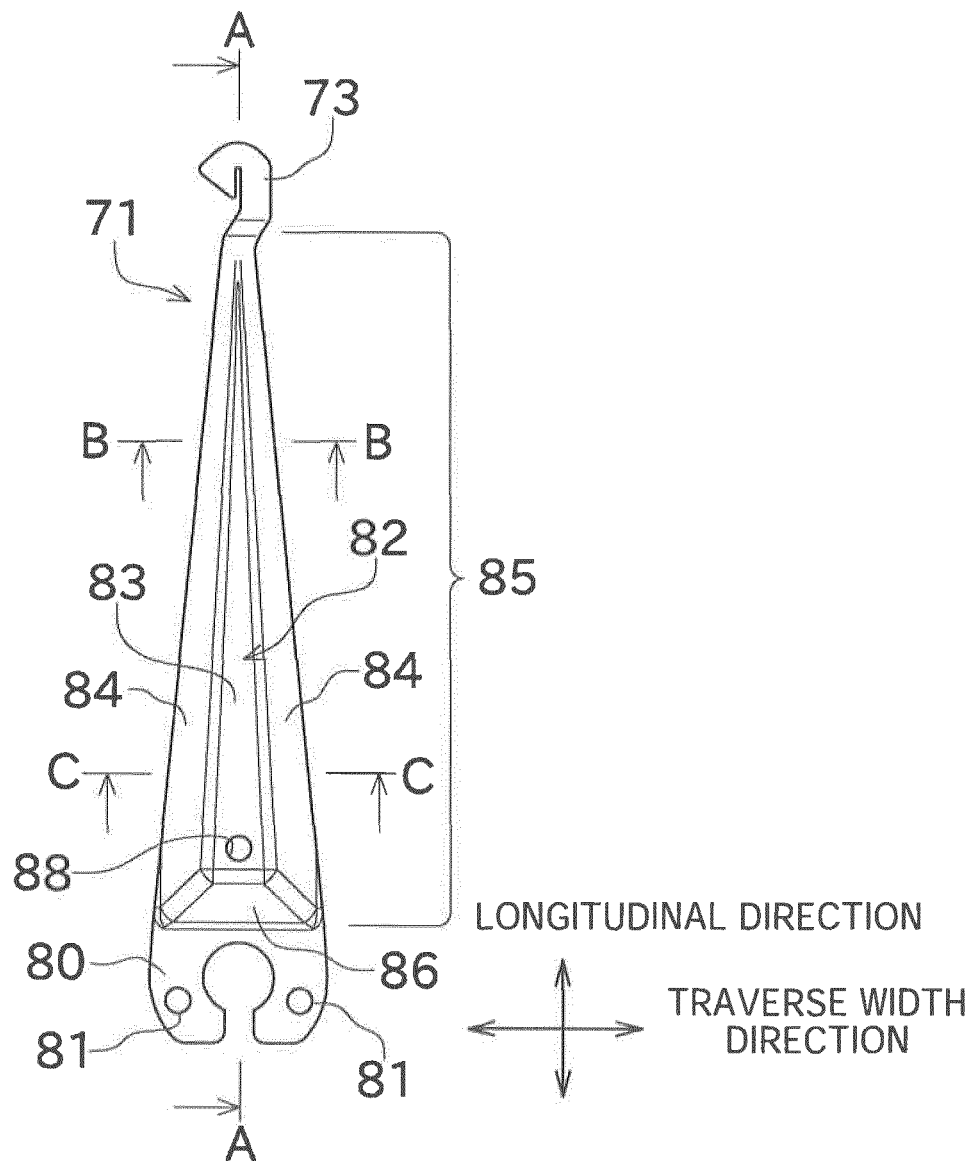


FIG. 6

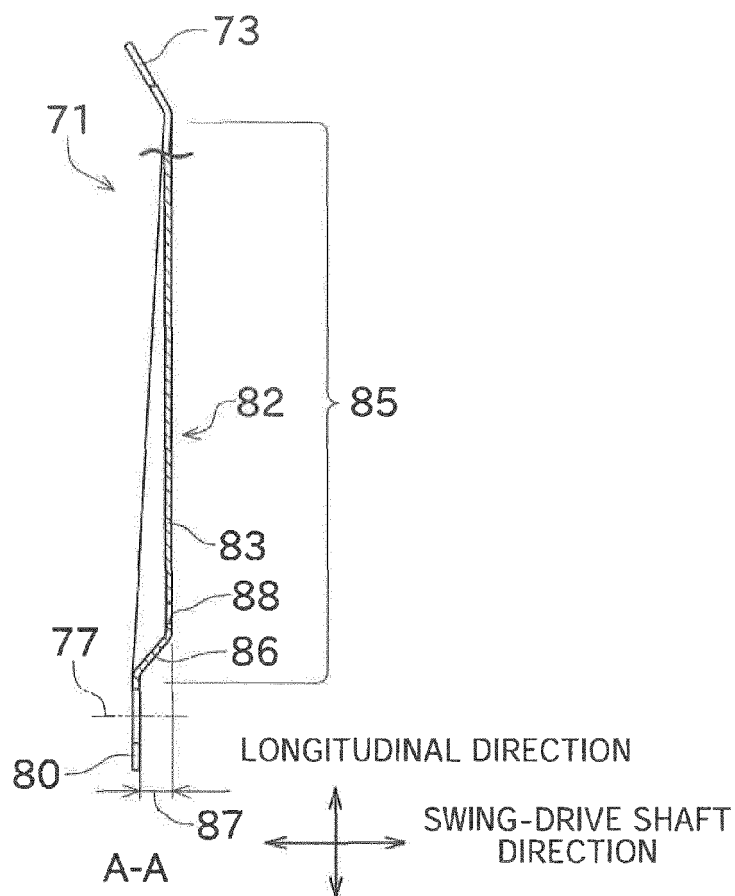
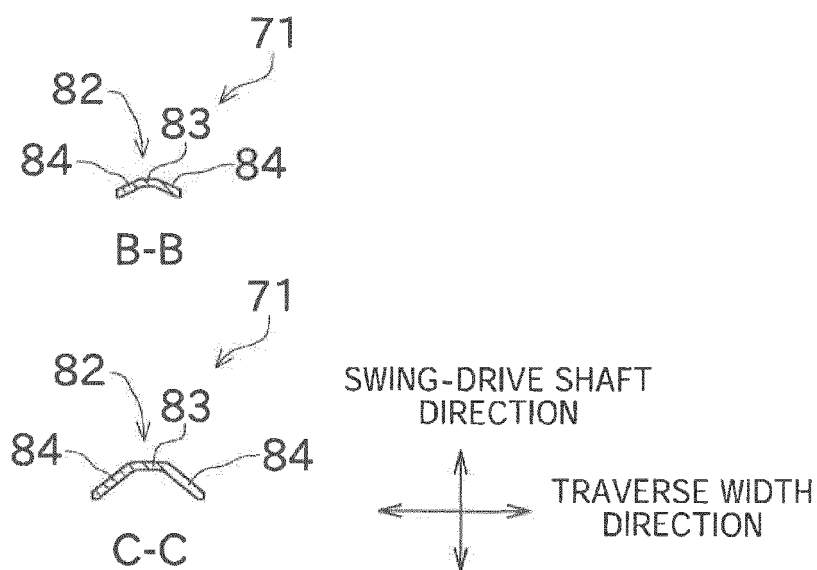


FIG. 7



REFERENCES CITED IN THE DESCRIPTION

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