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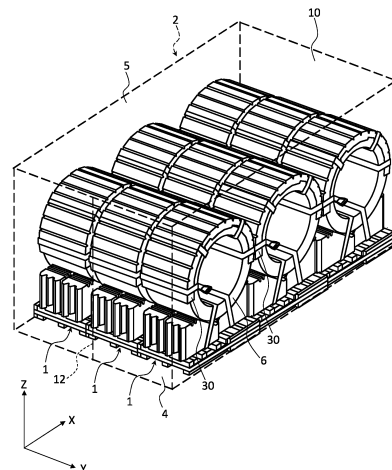
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(54) **PACKAGING BODY FOR WIRE COIL AND METHOD FOR LOADING WIRE COIL INTO CONTAINER**

(57) Provided is a packaging body 1 for a wire coil 6 which holds the wire coil 6 sideways, a plurality of the packaging bodies 1 being to be loaded in a single shipping container 2. The packaging body 1 comprises: a plurality of base beams 15 disposed on a container floor surface 4 and extending in one direction from a door of the shipping container 2 toward its back; a cross beam 33 extending in the width direction of the shipping container 2 and coupling the plurality of base beams 15; and a block-shaped coil holding stand 19 provided on the cross beam 33 and including a recessed section 21 in which to accommodate the wire coil 6 sideways with the axial direction of the cylinder oriented in the width direction of the shipping container 2, the coil holding stand 19 being a stand to which to lash the wire coil 6. The coil holding stand 19 includes a corrugated engagement section 23 on its front surface and back surface as viewed from the door 12 of the shipping container 2 toward its back, the wave direction of the corrugated engagement section 23 being oriented in the width direction of the shipping container 2 in plan view. The corrugated engagement section 23 engages a corrugated engagement section 23 of another packaging body 1. In this way, it is possible to provide a packaging body capable of increas-

ing the number of wire coils loadable in a container as compared to the conventional art without impairing the function of protecting wire coils.

FIG.1



Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to a packaging body for a wire coil and a method for loading a wire coil into a container by using the packaging body.

BACKGROUND ART

10 **[0002]** When a wire such as a steel wire is transported, the wire is sometimes wound into the shape of a cylinder and tied with bands into a form called a wire coil, which is then loaded into a container, loaded onto a transport equipment, such as a vessel, and transported. Here, wire coils are less rigid than steel strip coils, which are sheet steel wound into the shape of a cylinder, and therefore collapse more easily. Wire coils are sometimes loosely tied with bands to prevent scratching due to slippage between the steel wires. In this case, the wire coils collapse even more easily. When wire
15 coils are transported on a vessel, they may collapse inside the container due to the rocking of the hull caused by waves and the like. Also, wire coils of steel wires to be used for automobile fasteners and tire cord wires may be considered defective if scratched even slightly by collapse. Therefore, when wire coils are transported in a container on a vessel, the wire coils are sometimes held with packaging bodies and loaded in the container in order to prevent collapse.

20 **[0003]** Patent Document 1 discloses a packaging body for placing a wire coil on a pallet with the axis of the cylinder oriented vertically, as a packaging body to be used when a wire coil is loaded into a container. This packaging body is such that an abutment member of a regular octagonal ring shape that surrounds the outer periphery of a wire coil is provided above the pallet, and the pallet and the abutment member are coupled by square pipes extending downward from the abutment member.

25 **[0004]** This structure prevents a wire coil from collapsing inside a container by surrounding and protecting the wire coil with the abutment member, the square pipes, and the pallet. Also, such packaging bodies are positioned and restricted from moving inside a container by arraying them in such a staggered pattern that one edge of the regular octagon of the abutment member abuts a side surface of the container and an edge that does not abut the side surface of the container and is inclined relative to the side surface of the container abuts one edge of the regular octagon of another packaging body.

30 **[0005]** With this structure, however, the abutment member of the regular octagonal ring shape surrounds the outer periphery of a wire coil, and therefore the outer shape of the abutment member needs to be larger than the regular octagon, which is externally tangent to the circumference of the wire coil. This leads to a problem that it is difficult to increase the number of wire coils loadable in a container. Also, arraying regular octagonal abutment members in a staggered pattern forms a gap between packaging bodies in the array direction. This leads to a problem that it is difficult
35 to increase the number of wire coils loadable in a container.

PRIOR ART DOCUMENT

PATENT DOCUMENT

40 **[0006]** Patent Document 1: Description of International Publication No. WO 2004/069672

SUMMARY OF THE INVENTION

45 PROBLEM TO BE SOLVED BY THE INVENTION

[0007] The present invention has been made in view of the above circumstances, and an object thereof is to provide a packaging body capable of increasing the number of wire coils loadable in a container as compared to the conventional art without impairing the function of protecting wire coils.

50 MEANS FOR SOLVING THE PROBLEM

[0008] A packaging body according to an aspect of the present invention for achieving the above object is a packaging body for a wire coil being a wire wound into a shape of a cylinder and tied with a band, the packaging body being for
55 protecting the wire coil by holding the wire coil sideways such that an axis of the cylinder of the wire coil is oriented in a horizontal direction, a plurality of the packaging bodies being to be loaded in a single container, characterized in that: the packaging body including a plurality of base beams disposed on a floor surface of the container and extending in one direction from a door of the container toward a back thereof; a cross beam disposed on the plurality of base beams

so as to extend in a width direction of the container perpendicular to the one direction, and coupling the base beams; and a block-shaped coil holding stand provided on the cross beam and including a recessed section in which to accommodate the wire coil sideways with an axial direction of the cylinder oriented in the width direction of the container, the coil holding stand being a stand to which to lash the wire coil, in which the coil holding stand includes a corrugated engagement section on a front surface and a back surface as viewed from the door of the container toward the back thereof, a wave direction of the corrugated engagement section being oriented in the width direction of the container in plan view, the corrugated engagement section being configured to engage the corrugated engagement section of another one of the packaging bodies.

[0009] A method according to another aspect of the present invention is a method for loading a wire coil into a container by using the above packaging body, characterized in that: the method comprising: a coil loading step of loading the wire coil on the coil holding stand with the circumferential surface of the wire coil lying sideways; a coil lashing step of lashing the wire coil to the coil holding stand by passing a lashing belt through a hole portion of the cylinder of the wire coil, further passing the lashing belt through a gap between the coil holding stand and a container floor surface, and fastening the lashing belt into a loop; a roll cushion lashing step of covering at least the uppermost surface in the circumferential surface of the wire coil and part of the opposite end surfaces of the wire coil from above with the roll cushion, and lashing the roll cushion to the wire coil with a lashing belt; and a container loading step of loading a plurality of the packaging bodies having completed the roll cushion lashing step into the container such that the corrugated engagement sections face a front side and a back side, in which the container loading step includes a front-rear-direction fixing step of engaging the corrugated engagement sections of the packaging bodies adjacent in a front-rear-direction and also bringing the roll cushions on the packaging bodies into abutment with each other, and a width-direction fixing step of pushing another one of the packaging bodies into a gap between the packaging bodies adjacent in the width direction of the packaging bodies adjacent in the width direction or a gap between the packaging body and the container while compressing the beam cushioning members and the roll cushion.

[0010] With this configuration, the coil holding stand holds a coil so as to prevent it from being scratched. Moreover, a plurality of packaging bodies are positioned in a state of being arranged in tandem in the one direction from the door of the container toward its back and are restricted from moving relative to each other in the width direction of the container by engaging their corrugated engagement sections with each other.

EFFECT OF THE INVENTION

[0011] According to the present invention, it is possible to provide a packaging body capable of increasing the number of wire coils loadable in a container as compared to the conventional art without impairing the function of protecting wire coils.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

[Fig. 1] Fig. 1 is a perspective view illustrating a shipping container loaded with packaging bodies according to an embodiment of the present invention, in which the container is illustrated with dashed lines, depiction of the wires of wire coils is omitted, and only the outer coil shapes are illustrated.

[Fig. 2] Fig. 2 is a perspective view illustrating one of packaging bodies in Fig. 1.

[Fig. 3] Fig. 3 is a perspective view of the packaging body in Fig. 2 as viewed from another angle, in which depiction of the wire of the wire coil is omitted, and only the outer coil shape is illustrated.

[Fig. 4] Fig. 4 is a view illustrating a state where the wire coil and a roll cushion have been removed from the state illustrated in Fig. 3.

[Fig. 5] Fig. 5 is a top view of Fig. 4.

[Fig. 6] Fig. 6(a) is a top view illustrating a state where corrugated engagement sections of two packaging bodies are engaged, and Fig. 6(b) is a view illustrating a case where two wedge members in Fig. 6 (a) are not offset in the width direction of the shipping container.

[Fig. 7] Fig. 7 is a cross-sectional view along the A-A line in Fig. 3, in which illustration of the roll cushion is omitted.

[Fig. 8] Fig. 8 is an exploded view with an outer shell block detached from the state in Fig. 7.

[Fig. 9] Fig. 9 is a view illustrating a process of placing packaging bodies side by side inside the container.

[Fig. 10] Fig. 10 is a perspective view illustrating a modification of the packaging bodies.

[Fig. 11] Fig. 11 is a developed view of the roll cushion.

[Fig. 12] Fig. 12 is a view illustrating a process of loading a packaging body with a coiled object loaded thereon into the container, in which depiction of the wire of the wire coil is omitted, and only the outer coil shape is illustrated.

[Fig. 13] Fig. 13 is a view illustrating the process of loading a packaging body with a coiled object loaded thereon

into the container, in which depiction of the wire of the wire coil is omitted, and only the outer coil shape is illustrated.

[Fig. 14] Fig. 14 is a view illustrating the process of loading a packaging body with a coiled object loaded thereon into the container, in which depiction of the wire of the wire coil is omitted, and only the outer coil shape is illustrated.

[Fig. 15] Fig. 15 is a view illustrating a process of loading packaging bodies with coiled objects loaded thereon into the container, in which depiction of the wires of the wire coils is omitted, and only the outer coil shapes are illustrated.

[Fig. 16] Fig. 16 is a view illustrating the process of loading packaging bodies with coiled objects loaded thereon into the container, in which depiction of the wires of the wire coils is omitted, and only the outer coil shapes are illustrated.

[Fig. 17] Fig. 17 is a view illustrating the process of loading packaging bodies with coiled objects loaded thereon into the container, in which depiction of the wires of the wire coils is omitted, and only the outer coil shapes are illustrated.

[Fig. 18] Fig. 18 is a perspective view illustrating a packaging body according to a second embodiment, in which illustration of roll cushions is omitted.

[Fig. 19] Fig. 19 is a perspective view illustrating a packaging body according to a third embodiment, in which illustration of roll cushions is omitted.

[Fig. 20] Fig. 20 is a perspective view illustrating the packaging body according to the third embodiment, and illustrates a state where an engagement jig is engaged with corrugated engagement sections.

[Fig. 21] Fig. 21 is a top view illustrating a state where the packaging bodies according to the third embodiment with wire coils loaded thereon are loaded in the shipping container, in which illustration of roll cushions is omitted.

[Fig. 22] Fig. 22 is a top view illustrating a state where the packaging bodies according to the third embodiment with wire coils loaded thereon are loaded in the shipping container, in which illustration of roll cushions is omitted.

[Fig. 23] Fig. 23 is a top view illustrating a state where the packaging bodies according to the third embodiment with wire coils loaded thereon are loaded in the shipping container, in which illustration of roll cushions is omitted.

MODES FOR CARRYING OUT THE INVENTION

[0013] Preferred embodiments of the present invention will be described in detail below based on the drawings.

[0014] First, a configuration of a packaging body 1 according to a first embodiment of the present invention will be described with reference to Figs. 1 to 11. Note that, in the description, the depth direction of a shipping container 2 into which to load the packaging body 1 is an X direction, the vertical direction is a Z direction, and the width direction perpendicular to the X and Z directions is a Y direction.

[0015] Also, the drawings to be referred to are schematic drawings explaining embodiments, and the dimensional ratio between members and their shapes may differ from the actual ones in order to facilitate illustration and description.

[0016] Each packaging body 1 illustrated in Fig. 1 is a member that protects a wire coil 6 being a wire wound into the shape of a cylinder and tied with bands not illustrated from external impacts and the like by holding the wire coil 6 sideways such that the axis of the cylinder is oriented in a horizontal direction. As illustrated in Fig. 1, a plurality of packaging bodies 1 are loaded in a single shipping container 2. In Fig. 1, the shipping container 2 is loaded with three rows of packaging bodies 1 in the width direction and three rows of packaging bodies 1 in the depth direction, so that $3 \times 3 = 9$ packaging bodies 1 are disposed in a single shipping container 2. A single wire coil 6 is loaded on a single packaging body 1. However, a plurality of wire coils 6 may be loaded on a single packaging body 1 by, for example, tying the plurality of wire coils 6 with bands.

[0017] As illustrated in Fig. 1, the packaging bodies 1 are disposed in the shipping container 2 such that the axial direction of the cylinders of the wire coils 6 is oriented in the Y direction, which is the width direction of the shipping container 2. The shipping container 2 means a box-shaped transport container to be transported by a vehicle, a vessel, or the like with transport objects, which include the wire coils 6, loaded therein while protecting the transport objects from external forces.

[0018] The shipping container 2 only needs to have such a size as to be capable of accommodating a plurality of packaging bodies 1 with wire coils 6 loaded thereon, and to have such strength as not to be deformed by the weights of these or the vibration or impact during transport. Specific examples include 20-foot containers and 40-foot containers mainly used in marine transport.

[0019] As illustrated in Fig. 1, the shipping container 2 is a cuboidal body with a combination of square and rectangular surfaces, and a door 12 is provided at one of the square surfaces. Of the rectangular surfaces, the lower surface forms a container floor surface 4, the rectangular surfaces perpendicular to the container floor surface 4 are container sidewalls 5, and the upper surface opposed to the container floor surface 4 forms a top wall. The square surface opposed to the door 12 is a back wall 10. Incidentally, the left and right container sidewalls 5 are coupled by container cross beams not illustrated, and the container floor surface 4 is provided on the container cross beams. Thus, the container floor surface 4 and the container cross beams receive the loads of the packaging bodies 1 and the wire coils 6 loaded in the shipping container 2. From the viewpoint of transport efficiency, the shipping container 2 is preferably a container with standardized

dimensions, such as an ISO container, but may be a dedicated container.

[0020] As illustrated in Figs. 2 to 6, each packaging body 1 includes base beams 15, cross beams 33, a coil holding stand 19, beam cushioning members 20, and a roll cushion 30.

[0021] The base beams 15 are a plurality of support beams that receive the weight of the other constituent members of the packaging body 1 and the wire coil 6 loaded on the packaging body 1 and transmit the weight to the container cross beams of the shipping container 2. The base beams 15 are also used as slide plates that slide on the container floor surface 4 when the packaging body 1 is pulled into the shipping container 2 and pulled out of the shipping container 2.

[0022] While a single packaging body 1 includes three base beams 15 in Fig. 2, the number of base beams 15 may be selected as appropriate according to the weight of the wire coil 6 to be loaded on the packaging body 1.

[0023] Each base beam 15 is a prismatic member extending in the X direction as one direction, and a plurality of these are placed on the container floor surface 4 so as to extend in the X direction, which is the one direction from the door 12 of the shipping container 2 toward its back, and face one another in the state of being loaded in the shipping container 2. The length of the base beams 15 in the X direction is preferably greater than the diameter of the wire coil 6. With such a length, the wire coil 6 does not stick out beyond the base beams 15 in the X direction when the wire coil 6 is placed on the packaging body 1.

[0024] The base beams 15 are preferably made of a material that has such strength as not to be deformed by the weight of the other constituent members of the packaging body 1 and the wire coil 6 and is easily workable. Moreover, the material is preferably as light as possible in order to facilitate the transport of the packaging body 1 itself. The base beams 15 are also required to have wear resistance since they slide on the container floor surface 4 in the X direction at the time of loading into the shipping container 2. Examples of such a material include a wood such as laminated wood and plastic imitation wood. Plastic imitation wood is a resin mold obtained by molding and heating a piece of a resin such as polyethylene or polypropylene such that the strength and weight are adjusted to be similar to those of wood.

[0025] Whether to use laminated wood or plastic imitation wood may be determined as appropriate by taking the required strength, the cost, the environmental load, and so on into account. For example, laminated wood is more advantageous than plastic imitation wood in terms of cost. On the other hand, plastic imitation wood is advantageous in that the strength and weight can be easily adjusted by adjusting the material and dimensions of the resin piece and the molding conditions. Plastic imitation wood is also advantageous in that the resin piece as the raw material may be waste plastic, and thus the environmental load is lower than that of laminated wood, and also that even if the resin piece breaks, the broken material can be the raw material of new plastic imitation wood. Nonetheless, the environmental load of laminated wood is lower than that of solid wood since laminated wood is obtained by reusing wood that cannot be used as solid wood.

[0026] As illustrated in Figs. 2 to 6, the plurality of base beams 15 are coupled by the cross beams 33. The cross beams 33 too are beam-shaped members, and are disposed on the base beams 15 so as to extend in the Y direction, which is a direction perpendicular to the X direction, i.e., the width direction of the shipping container 2, in the state of being loaded in the shipping container 2.

[0027] The length of the cross beams 33 in the Y direction is preferably more than or equal to the axial length of the wire coil 6. With such a length, the wire coil 6 does not stick out beyond the packaging body 1 in the Y direction when the wire coil 6 is placed on the packaging body 1. The upper limit of the length of the cross beams 33 in the Y direction is such a length that the cross beams 33 can be loaded in the shipping container 2.

[0028] The number of cross beams 33 can be set as appropriate as long as they can restrain relative movement of the base beams 15 and be located so as not to obstruct the loading of the wire coil 6. Six cross beams 33 are illustrated in Fig. 2.

[0029] Publicly known fastening means, such as bolts, may be used as means for coupling the base beams 15 and the cross beams 33. Also, it is preferable to employ a structure in which the portions of the cross beams 33 to be coupled to the base beams 15 are formed in a recessed shape with a length corresponding to the width of the base beams 15 in the Y direction, and the base beams 15 are fitted in the recessed coupling portions. This is because, when the packaging body 1 is assembled, the recessed shape allows the worker to visually easily figure out the positions on the cross beams 33 to which to attach the base beams 15.

[0030] The cross beams 33 preferably have such strength as to be capable of coupling a pair of base beams 15 and holding the relative distance between the base beams 15 in the Y direction, and also are light in weight in order to facilitate the transport of the packaging body 1. Specifically, the cross beams 33 may be made of the same material as the base beams 15.

[0031] The coil holding stand 19 is a block-shaped member that directly contacts the wire coil 6 to receive and support its load, and is provided on the cross beams 33.

[0032] As illustrated in Figs. 4 to 7, the coil holding stand 19 includes a recessed section 21 and corrugated engagement sections 23.

[0033] The recessed section 21 is an accommodation section to accommodate the wire coil 6 sideways with the axial direction of the cylinder oriented in the width direction of the shipping container 2. Fig. 7 exemplarily illustrates a case

where the recessed section 21 has a V-shape as viewed from the Y direction, which is the width direction of the shipping container 2.

[0034] To form the recessed section 21 in the V-shape, the coil holding stand 19 has two wedge members 19a and 19b in the shape of a wedge each having an inclined surface 22 that supports the wire coil 6. With this structure, the tips of the wedges are brought into abutment with each other as illustrated in Fig. 7, so that the inclined surfaces 22 face each other and form a V-shaped groove section as the recessed section 21.

[0035] Thus, on the coil holding stand 19, the wire coil 6 is loaded in contact with the inclined surfaces 22 at the V-shaped groove section formed by bringing the wedge-shaped wedge members 19a and 19b into abutment with each other. In this way, even when the wire coil 6 deforms into a vertically elongated elliptical shape, a tip of the ellipse contacts the V-shaped groove and is restricted from moving downward and therefore does not contact the container floor surface 4. This will now be described more specifically.

[0036] The wire coil 6 is a coiled object obtained by winding a wire into the shape of a cylinder and tying the wound wire with bands. Thus, the wire tends to bend more easily than sheet steel coils when receiving an external force due to vibration or impact during transport. For this reason, the wire coil 6 having a circular outer shape in a view from the axial direction as illustrated with a solid line in Fig. 7 may deform into a vertically elongated elliptical shape as illustrated with the dashed line by being bent by an external force. In this case, the lower end of the ellipse moves down to a position lower than the lower end of the wire coil when it was circular. Then, depending on the shape of the packaging body 1, the lower end of the ellipse may contact the container floor surface 4 and get scratched. The coil holding stand 19, however, holds the wire coil 6 on the V-shaped groove section formed by bringing the wedge-shaped wedge members 19a and 19b into abutment with each other. Thus, once the lower end of the elliptical wire coil 6 contacts the deepest portion of the groove section, the lower end does not move any farther downward and therefore does not touch the container floor surface 4.

[0037] Also, as compared to a case where the recessed section 21 is an arc-shaped groove, the load of the wire coil 6 tends not to concentrate at one portion of the coil holding stand 19. This can reduce the burden on the container cross beams supporting the container floor surface 4.

[0038] While two pairs of wedge members 19a and 19b are illustrated in Figs. 3 to 7, the number of wedge members 19a and 19b is set according to the axial length of the wire coil 6. Specifically, in the state where the wedge members 19a and 19b are mounted on the cross beams 33, a distance D between the opposite ends in the Y direction illustrated in Fig. 5 is preferably greater than the axial length of the wire coil 6 since in this way the wire coil 6 does not stick out beyond the wedge members 19a and 19b. Incidentally, the wedge members 19a and 19b may be integrated with each other, but the integration makes the deepest portion of the V-shaped section more prone to cracking. Hence, being separate members is preferable.

[0039] The corrugated engagement sections 23 are members that allow the packaging body 1 to engage with other packaging bodies 1 to be positioned and fixed. As illustrated in Fig. 5, the corrugated engagement sections 23 are corrugated sections. The corrugated engagement sections 23 are provided on the front surface and back surface of the coil holding stand 19 as viewed from the door 12 of the shipping container 2 toward its back, and their wave direction is oriented in the Y direction, which is the width direction of the shipping container 2, in plan view.

[0040] As illustrated in Fig. 6(a), the corrugated engagement sections 23 are configured to engage the corrugated engagement sections 23 of other packaging bodies 1 adjacent in the X direction, which is a direction from the door 12 of the shipping container 2 toward its back, in the state where the packaging bodies 1 are loaded in the shipping container 2.

[0041] In the state where the corrugated engagement sections 23 are engaged with the corrugated engagement sections 23 of the other packaging bodies 1, when the packaging body 1 tries to move in the Y direction, which is the width direction of the shipping container 2, the corrugated engagement sections 23 of the other packaging bodies 1 prevent the movement. Also, when the other packaging bodies 1 try to move in the Y direction, the corrugated engagement sections 23 of the packaging body 1 prevent that movement. Moreover, when the packaging body 1 is loaded into the shipping container 2, inclined portions 23a of the corrugated engagement sections 23 of the other packaging bodies 1 serve as guides for positioning in the Y direction.

[0042] By providing the corrugated engagement sections 23 in this manner, a plurality of packaging bodies 1 are positioned so as to be arranged in tandem in the X direction and are restricted from moving in the width direction of the shipping container 2 with their corrugated engagement sections 23 engaged with one another, while the coil holding stands 19 holds wire coils 6 to prevent scratching.

[0043] In this way, it is possible to increase the number of wire coils 6 loadable in the shipping container 2 as compared to the conventional art without impairing the function of protecting wire coils 6.

[0044] While trapezoidal waves are exemplarily illustrated as the corrugated engagement sections 23 in Figs. 4 to 6, the shape of the waves can be set as appropriate as long as they can engage each other to allow positioning and restrict movement. Here, in the case of waves having portions perpendicular to the Y direction, which is the wave direction, such as rectangular waves, those perpendicular portions do not function as guides for positioning. For this reason, the waveform is preferably such that the inclined portions 23a, which serve as positioning guides, are as long as possible,

such as a trapezoidal, triangular, or sinusoidal shape.

[0045] If the wavelength of the waves is too long, the area of engagement is small, thereby weakening the effect of restricting movement. If the wavelength is too short, the strength is low, thereby making the corrugated portions easy to break. Thus, the wavelength is set as appropriate within such a range as to ensure strength.

[0046] Also, the higher the amplitude of the waves, the greater the holding force achieved by engagement, but an excessively high amplitude makes the corrugated portions easy to break. Thus, the amplitude is set as appropriate within such a range as to ensure strength. The wavelength, the amplitude, and the number of waves of the corrugated engagement sections 23 are the same on the wedge members 19a and 19b.

[0047] Incidentally, as illustrated in Fig. 5, the wedge members 19a and 19b are offset from each other in the Y direction, which is the extension direction of the cross beams 33, i.e., the width direction of the shipping container 2, by a length that is an odd multiple of a half wavelength of a wave on the corrugated engagement sections 23. In Fig. 5, the wedge members 19a and 19b are offset from each other by a length L that is a half wavelength of a wave on the corrugated engagement sections 23. Moreover, the wedge members 19a and 19b are disposed inward of the ends of the cross beams 33 and the base beams 15 in the extension direction of the cross beams 33.

[0048] In this configuration, as illustrated in Fig. 6(a), in the state where the corrugated engagement sections 23 of adjacent packaging bodies 1 are engaged with one another, their base beams 15 and cross beams 33 are not offset from one another in the Y direction, which is the width direction of the shipping container 2, and the ends of the cross beams 33 and the base beams 15 in the Y direction are aligned as indicated by dashed lines E.

[0049] Accordingly, the packaging bodies 1 can be arranged in tandem with their corrugated engagement sections 23 engaged with one another. This can increase the number of wire coils 6 loadable in the shipping container 2.

[0050] If the wedge members 19a and 19b are not offset in the Y direction, then, in the state where the corrugated engagement sections 23 are engaged with one another, the ends of the cross beams 33 and the base beams 15 of the adjacent packaging bodies 1 in the Y direction are offset from one another by the length L, which is a half wavelength of a wave, as illustrated in Fig. 6 (b) . In this state, a gap is formed in the Y direction between the adjacent packaging

bodies 1. This may reduce the number of wire coils 6 loadable in the shipping container 2.

[0051] Note that the length of the offset between the wedge members 19a and 19b may be an odd multiple of a half wavelength of a wave on the corrugated engagement sections 23. However, at the offset portions, the wedge members 19a and 19b do not abut each other, and thus do not form a V-shaped groove and do not have the function of holding a wire coil 6. Thus, the length of the offset is preferably as short as possible, and most preferably a half wavelength of a wave.

[0052] Also, the wedge members 19a and 19b are preferably disposed inward of the ends of the cross beams 33 and the base beams 15 in the width direction of the shipping container 2, which is the extension direction of the cross beams 33. Specifically, it is preferable that the wedge members 19a and 19b not stick out beyond the cross beams 33 and the base beams 15 in the Y direction. This is because if the wedge members 19a and 19b stick out beyond the cross beams 33 and the base beams 15 in the Y direction, a space is formed between the sticking portions, the container floor surface 4, and the cross beams 33 and the base beams 15, which may reduce the number of wire coils 6 loadable in the shipping container 2.

[0053] The wedge members 19a and 19b are made of such a material that the inclined surfaces 22 in contact with a wire coil 6 will not scratch the wire coil 6. Any material can be selected as appropriate as long as it does not get broken by the load of the wire coil 6 or vibration during transport.

[0054] Note that it is preferable to employ a double shell structure made of a plurality of different materials, as illustrated in Fig. 7. Specifically, the wedge members 19a and 19b preferably include an inner shell block 55 provided on cross beams 33, and an outer shell block 58 formed so as to cover the inner shell block 55 and having a wedge shape as its outer shape.

[0055] The inner shell block 55 is a member that supports the load of the wire coil 6 to prevent deformation of the wedge member 19a or 19b, and further includes a lower inner shell block 57, an upper inner shell block 59, and a coupling block 61.

[0056] The lower inner shell block 57 is a member with a long plate shape that serves as a base for the inner shell block 55, and is fixed to the cross beams 33. As illustrated in Fig. 7, the lower inner shell block 57 includes a lower coupling concavity 57a having a recessed shape in the upper surface. The upper inner shell block 59 is a block-shaped member to be mounted on the upper surface of the lower inner shell block 57, and includes an upper coupling concavity 59a having a recessed shape in the lower surface, which is located above the lower coupling concavity 57a in the state where the upper inner shell block 59 is mounted on the upper surface of the lower inner shell block 57.

[0057] The coupling block 61 is a block-shaped member that couples the lower inner shell block 57 and the upper inner shell block 59, and has an outer shape corresponding to the upper coupling concavity 59a and the lower coupling concavity 57a.

[0058] Thus, the upper inner shell block 59 and the lower inner shell block 57 can be coupled by inserting the coupling block 61 into the upper coupling concavity 59a and the lower coupling concavity 57a. When the upper inner shell block

59 and the lower inner shell block 57 in the coupled state try to move relative to each other in the X direction, the upper coupling concavity 59a and the lower coupling concavity 57a are caught on the coupling block 61, so that the movement is restricted.

[0059] As illustrated in Fig. 8, sections of the upper surfaces of the upper inner shell block 59 and the lower inner shell block 57 located under the inclined surface 22 are inclined downward in the same direction as the inclined surface 22. Specifically, the section of the lower inner shell block 57 located under the inclined surface 22 includes a lower inclined portion 57b inclined downward in the same direction as the inclined surface 22. The section of the upper inner shell block 59 located under the inclined surface 22 includes an upper inclined portion 59b inclined downward in the same direction as the inclined surface 22.

[0060] In this structure, the upper inner shell block 59 can be coupled to the lower inner shell block 57 as long as the upper coupling concavity 59a has such a shape that the coupling block 61 can be inserted thereto. Thus, by preparing a plurality of upper inner shell blocks 59 differing in shape, dimension, and strength, the upper inner shell block 59 suitable to be coupled to the lower inner shell block 57 can be changed according to the dimensions, weight, and the like of the wire coil 6.

[0061] Further, as illustrated in Fig. 7, the upper inclined portion 59b and the lower inclined portion 57b of the upper surfaces of the upper inner shell block 59 and the lower inner shell block 57, which are inclined surfaces located under the inclined surface 22, have arc shapes bulging upward as viewed from the Y direction, which is the extension direction of the cross beams 33. Such a shape is also called a fan shape.

[0062] By forming the inclined surfaces in a fan shape as described above, the inclined surfaces support the wire coil 6 as an arch structure. In this way, the strength of the inner shell block 55 against the load of the wire coil 6 is improved as compared to the case of forming the inclined surface as a straight structure.

[0063] The outer shell block 58 is a member that directly contacts the wire coil 6 and allows the coil holding stand 19 to be supported by the base beams 15.

[0064] As illustrated in Fig. 7, the outer shell block 58 is disposed so as to cover the inner shell block 55 from outside, and includes the inclined surface 22.

[0065] The outer shell block 58 is held on the inner shell block 55 but they are only fitted to each other and not fastened with bolts or the like.

[0066] Specifically, as illustrated in Fig. 8, an accommodation concavity 58a corresponding to the outer shape of the inner shell block 55 is formed in the bottom surface of the outer shell block 58, and the inner shell block 55 is covered with the outer shell block 58 from outside by inserting and fitting the inner shell block 55 into the accommodation concavity 58a of the outer shell block 58.

[0067] The inner shell block 55 and the outer shell block 58 differ in material. Specifically, the outer shell block 58 is made of a softer material than the material of the inner shell block 55. A harder material refers to a material that is deformed to a smaller extent when pressed against another material. Conversely, a softer material refers to a material that is deformed to a greater extent when pressed against another material. This also applies to the following description.

[0068] With this configuration, when a wire coil 6 is loaded on the packaging body 1, the inclined surface 22 of the outer shell block 58 receives the load of the wire coil 6 and thus supports the wire coil 6 together with the inner shell block 55 without getting the wire coil 6 scratched. The vertical component of the load of the wire coil 6 applied to the packaging body 1 is transmitted to the container cross beams through the coil holding stand 19, the cross beams 33, and the base beams 15.

[0069] Scratching of the wire coil 6 can be prevented by bringing the softer outer shell block 58 and the wire coil 6 into contact with each other while supporting the load of the coil with the harder inner shell block 55 to prevent deformation of the wedge member 19a or 19b as described above.

[0070] Also, when the load concentrates at one portion of the outer shell block 58, the inner shell block 55 receives the load and distributes the load to the cross beams 33 and the base beams 15. This can reduce the burden on the container cross beams supporting the container floor surface 4.

[0071] Examples of the constituent material of the outer shell block 58 include a bead-method expanded polyolefin. The bead-method expanded polyolefin is a material expanded when an olefin such as ethylene or propylene is condensed into a polyolefin. The bead-method expanded polyolefin is preferable since it is softer than materials obtained by expanding styrene, such as styrofoam. Specific examples of the bead-method expanded polyolefin include bead-method expanded polyethylene and bead-method expanded polypropylene.

[0072] Since the inner shell block 55 does not directly contact the wire coil 6, its abrasiveness on the wire coil 6 does not need to be considered unlike the outer shell block 58, and the material only needs to be one harder than the outer shell block 58.

[0073] Nonetheless, the inner shell block 55 and the outer shell block 58 do not need to be made of completely different materials as long as the material of the inner shell block 55 is harder than that of the outer shell block 58. Specifically, the upper inner shell block 59 and the outer shell block 58 may each be formed of a bead-method expanded polyolefin, with the material of the outer shell block 58 being higher in expansion ratio. This is because, with the same composition,

a bead-method expanded polyolefin with a higher expansion ratio has higher porosity and is therefore softer. In this case, it is preferable to make the upper inner shell block 59 of the inner shell block 55 from a bead-method expanded polypropylene with an expansion ratio of 8 to 15, and make the outer shell block 58 from a bead-method expanded polyethylene with an expansion ratio of 18 to 20. This is because bead-method expanded polypropylene is more resistant to deformation by external forces than bead-method expanded polyethylene. Note that the lower inner shell block 57 may be laminated wood or plastic imitation wood.

[0074] These compositions are advantageous in productivity since the upper inner shell block 59 and the outer shell block 58 with different physical properties can be manufactured with the same polyolefin manufacturing apparatus by only changing the raw material and the expansion conditions during the manufacture.

[0075] Note that the upper inner shell block 59 may be made of a material other than a bead-method expanded polyolefin such as laminated wood or plastic imitation wood as long as it is harder than the outer shell block 58. However, laminated wood and plastic imitation wood tend to be heavy and are therefore not suitable for safe and simple lashing work.

[0076] For this reason, by making the upper inner shell block 59 and the outer shell block 58 from bead-method expanded polyolefins differing in expansion ratio or substance, it is possible to prevent scratching of the wire coil 6 and also implement simple and safe lashing work while satisfying requirements for safe transport.

[0077] Incidentally, when the wedge members 19a and 19b employ the double shell structure, there is a possibility that the load of the wire coil 6 may disengage the corrugated engagement sections 23. This will now be described.

[0078] The coil holding stand 19 receives the load of the wire coil 6 on the inclined surfaces 22, which are inclined downward. Thus, the inclined surface 22 of the outer shell block 58 is pulled in a direction H1 illustrated in Fig. 7 by the load of the wire coil 6.

[0079] As the inclined surface 22 is pulled in the direction H1, the corrugated engagement sections 23 engaged with each other may be moved in such directions as to get separated from each other and float and thus be disengaged.

[0080] Hence, to prevent the floating of the corrugated engagement sections 23, the coil holding stand 19 includes inner-shell corrugated portions 62a, outer-shell corrugated portions 62b, block groove portions 54a, tenons 56a, and mortise 56b, as illustrated in Fig. 8.

[0081] Specifically, as illustrated in Fig. 8, the inner-shell corrugated portions 62a are provided in the upper surface of the inclined surface of the upper inner shell block 59. The inner-shell corrugated portions 62a are portions that appear corrugated as viewed from the Y direction, which is the extension direction of the cross beams 33.

[0082] Also, as illustrated in Fig. 8, the outer-shell corrugated portions 62b with a corrugated shape that engage the inner-shell corrugated portions 62a are formed on the surface of the outer shell block 58 to be in contact with the inclined surface of the inner shell block 55, i.e., the upper surface of the accommodation concavity 58a.

[0083] Moreover, as illustrated in Fig. 8, the upper inner shell block 59 includes a flat section 35 on its upper surface situated closer to the longitudinal ends of the base beams 15 than the inclined surface 22 is. The flat section 35 includes the block groove portions 54a extending in the Y direction, which is the extension direction of the cross beams 33.

[0084] Also, the upper inner shell block 59 includes a tenon or mortise provided along the vertical direction on or in its vertical surface facing the corrugated engagement section 23. In Fig. 8, the tenon 56a is illustrated.

[0085] On the other hand, the outer shell block 58 has a mortise or tenon that engages the tenon or mortise in or on its inner peripheral surface facing the vertical surface of the upper inner shell block 59. In Fig. 8, the mortise 56b is illustrated, which engages the tenon 56a.

[0086] With this structure, when the inclined surface 22 of the upper inner shell block 59 is pulled in the direction H1 illustrated in Fig. 7 by the load of the wire coil 6, the floating of the corrugated engagement sections 23 is prevented as follows.

[0087] First, the inner-shell corrugated portions 62a and the outer-shell corrugated portions 62b engage each other, thereby preventing movement of the outer shell block 58 relative to the inner shell block 55 in the direction H1. This prevents the corrugated engagement section 23 from being pulled and floated.

[0088] Next, even if the corrugated engagement section 23 is pulled, the block groove portions 54a deform so as to stretch horizontally as indicated by an arrow H3 in Fig. 7, thereby preventing transmission of the pulling force to the corrugated engagement section 23. This prevents the corrugated engagement section 23 from being pulled in the direction H1 and disengaged.

[0089] Further, the outer shell block 58 and the upper inner shell block 59 engage each other at the tenon 56a and the mortise 56b, thereby restricting horizontal movement. This prevents the corrugated engagement sections 23 from being pulled in the direction H1 and disengaged.

[0090] The wire coil 6 loaded on the coil holding stand 19 is lashed to it. Specifically, as illustrated in Fig. 2, the wire coil 6 is lashed by passing lashing belts 18 through the gaps between a plurality of cross beams 33 under the coil holding stand 19 and further passing the lashing belts 18 through the hole portion of the cylinder of the wire coil 6. In this way, the wire coil 6 is fixed to the coil holding stand 19. By lashing the wire coil 6 to the coil holding stand 19 instead of to the shipping container 2 as described above, the shipper can guarantee lashing strength even when it is difficult for the shipper to guarantee lashing strength by lashing the wire coil 6 to the shipping container 2 due to aging or the like of the

shipping container 2. This will now be described specifically.

[0091] In the case of lashing a wire coil 6 to the shipping container 2, whether the wire coil 6 is properly lashed or not depends on the strength of the shipping container 2. Here, the strength of the shipping container 2 may have dropped due to aging even if it is a standardized product, such as an ISO container. The owner of the shipping container 2 is not necessarily the shipper, in which case it is difficult for the shipper to guarantee the strength of the shipping container 2.

[0092] On the other hand, the packaging body 1 is dedicated for transport of a wire coil 6, and the shipper is its owner. Accordingly, it is easier to guarantee the strength of the packaging body 1 than that of the shipping container 2.

[0093] The beam cushioning members 20 are members that relax the impact of contact with the base beams 15 and the cross beams 33 of packaging bodies 1 adjacent in the Y direction, which is the width direction of the shipping container 2, when the packaging body 1 is loaded in the shipping container 2. The beam cushioning members 20 are also members that get compressed at the time of pushing another packaging body 1 into a gap between packaging bodies 1 so that the packaging body 1 can be squeezed in the narrow gap.

[0094] As illustrated in Figs. 3 to 5, the beam cushioning members 20 are a pair of plate-shaped members fixed to opposite ends of the cross beams 33 along the extension direction of the base beams 15. Here, the beam cushioning members 20 are tied to the base beams 15 and the cross beams 33 with a band 37 wrapped around the base beams 15 and the cross beams 33.

[0095] As illustrated in Fig. 9(a), in the case of squeezing a packaging body 1c into a gap between two packaging bodies 1a and 1b, the packaging body 1c is pushed in in the X direction with a beam cushioning member 20 of the packaging body 1c pressed against a beam cushioning member 20 of the packaging body 1b, so that the beam cushioning members 20 compress each other. Thus, the beam cushioning members 20 absorb the impact when the packaging bodies 1b and 1c come into contact with each other. This can prevent scratching of the base beams 15 and the cross beams 33 and also prevent scratching of the wire coils 6 due to the impact of the contact.

[0096] Also, when the packaging bodies 1b and 1c come into contact with each other, their beam cushioning members 20 are pressed against each other and thus compressed. Accordingly, even when the gap into which to squeeze the packaging body 1c is narrower than the width of the packaging body 1c, the packaging body 1c can be squeezed in as long as the difference between the widths is within the range within which the beam cushioning members 20 can be compressed.

[0097] Moreover, after being squeezed in, the beam cushioning members 20 push each other back as they try to return to the original state from the compressed state, and thus function to restrict relative movement of the packaging bodies 1b and 1c in the X and Y directions. The material of the beam cushioning members 20 is preferably one that deforms to a great extent when pressed against the base beams 15 and the cross beams 33, that is, a material softer than the base beams 15 and the cross beams 33, so that the beam cushioning members 20 can get compressed at the time of being squeezed in. Examples of such a material include the same material as the outer shell block 58.

[0098] The beam cushioning members 20 extend in the same direction as the base beams 15, but the length in their extension direction, which is the length in the X direction here, does not necessarily have to be the same length as the length of the base beams 15 of their extension direction. That is, the beam cushioning members 20 do not need to cover the entire side surfaces of the base beams 15 located at the opposite ends in the Y direction. Also, the beam cushioning members 20 do not need to cover the opposite ends of all cross beams 33.

[0099] For example, the length of the pair of beam cushioning members 20 illustrated in Fig. 5 in the X direction, which is their extension direction, may be less than a half of the length of the base beams 15, and the beam cushioning members 20 may be disposed to be point-symmetric in plan view at the opposite ends of the cross beams 33 and one end of each of base beams 15 in their extension direction opposed to the other. In Fig. 5, the beam cushioning members 20 are provided at the upper left corner and the lower right corner in plan view.

[0100] With this structure, as illustrated in Fig. 9(b), the packaging bodies 1 adjacent in the Y direction are such that their beam cushioning members 20 are in contact only with the base beams 15 and the cross beams 33, and the beam cushioning members 20 are in contact with each other only until a packaging body 1 is partly squeezed in.

[0101] Incidentally, as illustrated in Fig. 10, the beam cushioning members 20 may cover the base beams 15 over the same length as the length of the base beams 15 in the X direction, which is the extension direction.

[0102] Whether to make the length of the beam cushioning members 20 less than a half of the length of the base beams 15 or the same length may be determined as appropriate by taking the advantage of each into consideration.

[0103] For example, in the case where the length of the beam cushioning members 20 is less than a half of the length of the base beams 15 as illustrated in Fig. 3, the beam cushioning members 20 of packaging bodies 1 adjacent in the Y direction contact only the base beams 15 and the cross beams 33, and the beam cushioning members 20 do not contact each other. On the other hand, in the case where the length of the beam cushioning members 20 is the same length as the length of the base beams 15 as illustrated in Fig. 10, the beam cushioning members 20 of packaging bodies 1 adjacent in the Y direction contact each other. Accordingly, in the case where the length is less than a half of the length of the base beams 15, the gap in which a packaging body 1 can be squeezed is narrower by the thickness of a single beam cushioning member 20. Thus, when it is desirable to squeeze a packaging body 1 in a narrow gap, it

is advantageous for the length of the base beams 15 to be less than a half length.

[0104] On the other hand, when the length of the beam cushioning members 20 is the same length as the length of the base beams 15, there are always two beam cushioning members 20 sandwiched between the base beams 15 and the cross beams 33 of adjacent packaging bodies 1. This enables the beam cushioning members 20 to exhibit a better impact absorbing effect.

[0105] The roll cushion 30 is a member that protects the circumferential surface and flat end surfaces of a wire coil 6 by covering them from above, and also stops the wire coil 6 from moving to prevent scratching thereof by abutting the roll cushions 30 of other packaging bodies 1 and thereby restricting each other's movement.

[0106] As illustrated in Fig. 11, the roll cushion 30 is a sheet-shaped member that is long and bendable into a roll shape.

[0107] The length of long edges 31a of the roll cushion 30 is about a half of the circumferential length of the wire coil 6. Accordingly, the roll cushion 30 covers about a half of a part of the wire coil 6 including the uppermost surface in its circumferential surface from above in a state of being bent in a roll shape. The length of short edges 31b of the roll cushion 30 is longer than the axial length of the wire coil 6. In the state of covering the circumferential surface of the wire coil 6, portions sticking out beyond the opposite axial ends of the wire coil 6, which in Fig. 11 are the portions indicated by the dashed lines, are folded at a right angle into abutment with the flat surfaces. Thus, the roll cushion 30 covers part of the opposite end surfaces of the wire coil 6 from above. In this state, lashing belts 18 are passed from the upper surface of the roll cushion 30 through the hole in the cylinder of the wire coil 6 and fastened. As a result, the roll cushion 30 is lashed to the wire coil 6.

[0108] The roll cushion 30 in this state protects the wire coil 6 by being lashed to the wire coil 6 with the lashing belts 18 in the state of covering at least the uppermost surface in the circumferential surface of the wire coil 6 and part of its opposite end surfaces from above.

[0109] In the state where a plurality of packaging bodies 1 are loaded in the shipping container 2 as illustrated in Fig. 1, each roll cushion 30 abuts the roll cushions 30 of other adjacent packaging bodies 1 to restrict one another's movement. Specifically, first, longitudinal end portions of the section of the roll cushion 30 covering the circumferential surface of a wire coil 6 abut longitudinal end portions of the sections of the roll cushions 30 on other packaging bodies 1 covering the circumferential surfaces of wire coils 6 thereon, the other packaging bodies 1 being adjacent in the X direction, which is the depth direction of the shipping container 2. This restricts relative movement of the wire coils 6 in the X direction. Moreover, the sections covering the opposite end surfaces of a wire coil 6 abut sections of the roll cushions 30 on other packaging bodies 1 covering the opposite end surfaces of wire coils 6 thereon, the other packaging bodies 1 being adjacent in the Y direction, which is the width direction of the shipping container 2. This restricts relative movement of the wire coils 6 in the Y direction.

[0110] As described above, each packaging body 1 protects a substantially upper half of a wire coil 6 by covering it with the roll cushion 30, and also restricts movement of the wire coil 6 by abutting other packaging bodies 1. The lower half is protected by being accommodated in the recessed section 21 of the coil holding stand 19, and is also restricted from moving as the corrugated engagement sections 23 and the beam cushioning members 20 engage and contact the coil holding stands 19 of other packaging bodies 1. Hence, it is possible to protect each wire coil 6 restrict its movement without surrounding the entire wire coil 6.

[0111] As the roll cushion 30, any structure can be selected as appropriate as long as it can be bent in the longitudinal direction into a roll shape and end portions sticking out beyond the wire coil 6 in the bent state can be folded. For example, a bellows shape is preferable which, as illustrated in Fig. 11, has straight cuts 30a provided at predetermined intervals in the longitudinal direction as fold lines extending in a direction perpendicular to the longitudinal direction. By folding the roll cushion 30 at the cuts 30a, the roll cushion 30 can be easily bent in the longitudinal direction into a roll shape. Also, when the roll cushion 30 is not used, it can be easily rolled up and stored.

[0112] Also, as illustrated in Fig. 11, it is preferable that the linear width of the cuts 30a of the roll cushion 30, i.e., the width of the short edges 31b, be longer than the axial length of the coil and that a plurality of notches 30b be provided in the opposite ends in the transverse direction.

[0113] Providing the plurality of notches 30b makes it easier to fold the end portions in the transverse direction between the plurality of notches 30b and thus protect the end surfaces of the wire coil 6.

[0114] The material of the roll cushion 30 can be selected as appropriate as long as the material has such flexibility as to be bent in the longitudinal direction and in the transverse direction, and is capable of protecting a wire coil 6 without scratching the wire coil 6 when in contact with it and without being easily broken by external forces. For example, the material may be the same material as the outer shell block 58 of the coil holding stand 19.

[0115] This concludes the description of a configuration of the packaging body 1.

[0116] Next, a method for loading wire coils 6 into a container by using packaging bodies 1 will be described with reference to Figs. 12 to 17. In this loading method, a coil loading step, a coil lashing step, a roll cushion lashing step, and a container loading step are performed in a process of loading cargo into a container, which is called vanning.

[0117] First, in the coil loading step, as illustrated in Fig. 12, a wire coil 6 is loaded on the coil holding stand 19 with its circumferential surface lying sideways. Specifically, the wire coil 6 is placed on the coil holding stand 19 such that

the circumferential surface of the wire coil 6 abuts the inclined surfaces 22 of the V-shaped groove section.

[0118] Next, in the coil lashing step, as illustrated in Fig. 13, lashing belts 18 are passed through the hole portion of the cylinder of the wire coil 6. Moreover, each lashing belt 18 is passed through the gap between the coil holding stand 19 and the container floor surface 4, which is the gap between a plurality of cross beams 33 under the coil holding stand 19 here, and fastened into a loop. As a result, the wire coil 6 is lashed to the coil holding stand 19.

[0119] Next, in the roll cushion lashing step, as illustrated in Fig. 14, at least the uppermost surface in the circumferential surface of the wire coil 6 and part of its opposite end surfaces are covered with the roll cushion 30 from above. Moreover, the end portions of the roll cushion 30 sticking out in the axial direction of the wire coil 6 are folded into abutment with the end surfaces of the wire coil 6. In this state, lashing belts 18 are passed through the hole portion of the cylinder of the wire coil 6, wrapped around the roll cushion 30, and fastened. As a result, the roll cushion 30 is lashed to the wire coil 6.

[0120] The coil loading step, the coil lashing step, and the roll cushion lashing step are performed as many times as the number of wire coils 6 to be loaded into a single container.

[0121] Incidentally, wire coils 6 are sometimes stored temporarily in a storage place, such as a vanning warehouse, if it takes time before they are loaded into the shipping container 2 after being carried out of the manufacturing factory. In this case, before being temporarily stored, the wire coils 6 may be subjected to the coil loading step, the coil lashing step, and the roll cushion lashing step, and temporarily stored in the storage place in the state of the packaging body 1 as illustrated in Fig. 2. By temporarily storing the wire coils 6 in the state of the packaging body 1 as described above, it is possible to prevent the wire coils 6 from being scratched by contacting the floor of the storage place or from being scratched by collapsing during the storage. Also, at the time of vanning, the wire coils 6 can be carried out of the storage place in the state of the packaging body 1 and loaded into the shipping container 2. This can improve the efficiency of the vanning work and reduce the labor of the vanning work.

[0122] The plurality of packaging bodies 1 having completed the roll cushion lashing step are loaded into a single shipping container 2 in the container loading step. A specific process is as follows.

[0123] First, as illustrated in Fig. 15, each packaging body 1 is loaded into the shipping container 2 with the corrugated engagement sections 23 facing the front surface and back surface of the shipping container 2. To be loaded, the packaging body 1 is firstly lifted up with a forklift or the like and unloaded on the container floor surface 4 near the door of the shipping container 2. Then, a jig such as a pushing bar is attached to the forklift, and, for example, the base beams 15 and the cross beams 33 of the packaging body 1 are pushed with the jig, so that the packaging body 1 is moved in the X direction and pushed in to the back of the shipping container 2.

[0124] At this time, the packaging body 1 is preferably pushed in to such a position as not be in contact with another packaging body 1 from the beginning. In the first embodiment, $3 \times 3 = 9$ packaging bodies 1 are loaded into one shipping container 2. Thus, in Fig. 15, first, the packaging bodies 1a and 1b are pushed in into abutment with the back wall 10 and the left and right container sidewalls 5 of the shipping container 2. Accordingly, a space to load one packaging body 1 is left between the two packaging bodies 1. Nonetheless, the two packaging bodies 1 may be loaded in contact with each other in the width direction of the shipping container 2. In this case, a space to load the one remaining packaging body 1 is left between a container sidewall 5 and one of the packaging bodies 1.

[0125] Next, as illustrated in Fig. 16, another packaging body 1c is pushed in between the two packaging bodies 1. At this time, the packaging body 1c is pushed in in the X direction with its beam cushioning member 20 pressed against a beam cushioning member 20 of the packaging body 1b, so that the beam cushioning members 20 compress each other. Moreover, at this time, the sections of the roll cushions 30 covering the end surfaces of the respective wire coils 6 come into abutment with one another as well. Thus, the packaging body 1c is pushed in with the abutting portions of its roll cushion 30 compressed as well. After being pushed in, the packaging bodies 1a, 1b, and 1c are restricted from moving relative to one another by the repulsive forces against the compression of their beam cushioning members 20 and roll cushions 30 (width-direction fixing step).

[0126] In the case of loading two packaging bodies 1 in contact with each other and squeezing the remaining packaging body 1 in the space between a container sidewall 5 and one of the packaging bodies 1, the packaging body 1 to be squeezed in is pushed in with its beam cushioning members 20 and roll cushion 30 pressed against the packaging body 1 and the container sidewall 5, so that beam cushioning members 20 and roll cushion 30 are compressed. In this case too, the packaging bodies 1a, 1b, and 1c are restricted from moving relative to one another by the repulsive forces against the compression of their beam cushioning members 20 and roll cushions 30.

[0127] Next, as illustrated in Fig. 17, another packaging body 1d is loaded before the packaging bodies 1a to 1c. At this time, corrugated engagement sections 23 of the packaging bodies 1 adjacent in the front-rear-direction, which is the depth direction of the shipping container 2 here, are engaged with each other, and their roll cushions 30 are brought into abutment with each other as well (front-rear-direction fixing step).

[0128] In Fig. 17, the corrugated engagement section 23 on the front surface of the packaging body 1a and the corrugated engagement section 23 on the back surface of the packaging body 1d are engaged with each other. Moreover, the sections of the roll cushions 30 covering the circumferential surfaces of the respective wire coils 6 are brought into contact with each other.

[0129] After this, the width-direction fixing step and the front-rear-direction fixing step are repeated until all packaging bodies 1 to be loaded in the shipping container 2 are loaded in the shipping container 2.

[0130] This concludes the description of a method for loading wire coils 6 into a container by using packaging bodies 1.

[0131] As described above, the packaging body 1 in the first embodiment includes the base beams 15, the cross beams 33, and the coil holding stand 19, and the coil holding stand 19 includes the corrugated engagement sections 23 on the front surface and back surface as viewed from the door 12 of the shipping container 2 toward its back, the wave direction of the corrugated engagement sections 23 being oriented in the width direction of the shipping container 2 in plan view.

[0132] With this configuration, the coil holding stand 19 holds a wire coil 6 to prevent it from being scratched. Moreover, a plurality of the packaging bodies 1 are positioned in a state of being arranged in tandem in the one direction from the door 12 of the shipping container 2 toward its back and are restricted from moving relative to each other in the width direction of the shipping container 2 by engaging their corrugated engagement sections 23 with each other.

[0133] Thus, the packaging body 1 can increase the number of wire coils 6 loadable in the shipping container 2 as compared to the conventional art without impairing the function of protecting wire coils 6.

[0134] Next, a configuration of a packaging body 1a according to a second embodiment will be described with reference to Fig. 18. The second embodiment corresponds to the first embodiment in which a plurality of wire coils 6 are loaded on a single packaging body. Note that elements in the second embodiment that serve functions similar to those in the first embodiment are denoted by the same numbers, and description thereof is omitted.

[0135] As illustrated in Fig. 18, the packaging body 1a according to the second embodiment is such that the length of the cross beams 33 is about three times the length of the cross beams 33 in the first embodiment. Moreover, six wedge members 19a and six wedge members 19b each having the same dimensions as those in the first embodiment are disposed along the Y direction. Furthermore, the dimensions of the base beams 15 are the same as the dimensions of the base beams 15 in the first embodiment. Thus, the packaging body 1a has an outer shape obtained by extending the packaging body 1 according to the first embodiment in the Y direction. Thus, the packaging body 1a is configured such that three wire coils 6 can be loaded thereon along the Y direction, which is the width direction of the shipping container 2, on condition that each wire coil 6 has the same dimensions as those of the wire coil 6 loaded on the packaging body 1 according to the first embodiment.

[0136] As described above, the packaging body 1a may be configured such that a plurality of wire coils 6 can be loaded thereon.

[0137] Incidentally, if the largest width of the packaging body 1a in the Y direction is substantially equal to the width of the shipping container 2 in the Y direction, it will be easy to position the packaging body 1a in the Y direction at the time of loading into the shipping container 2.

[0138] Whether to select the configuration in which a single wire coil 6 is loaded on a single packaging body 1 as in the first embodiment or the configuration in which a plurality of wire coils 6 are loaded on a single packaging body 1a as in the second embodiment may be selected as appropriate by taking the advantage of each into consideration.

[0139] For example, in the configuration in which a single wire coil 6 is loaded on a single packaging body 1 as in the first embodiment, the single packaging body 1 surrounds the outer periphery of the single wire coil 6. This is advantageous from the viewpoint of preventing scratching and deformation of the wire coil 6.

[0140] On the other hand, with the configuration in which a plurality of wire coils 6 are loaded on a single packaging body 1a as in the second embodiment, the number of packaging bodies 1a required to transport wire coils 6 is smaller than when packaging bodies 1 are used. This is advantageous in terms of transport cost.

[0141] Next, a configuration of a packaging body 1b according to a third embodiment will be described with reference to Figs. 19 to 22.

[0142] The packaging body 1b according to the third embodiment is such that longitudinal end portions 15a of the base beams 15 in the second embodiment project beyond the corrugated engagement sections 23 in the X direction. Moreover, convexities 71 are provided on the upper surfaces of the projecting portions. Furthermore, an engagement jig 73 to be fitted to the convexities 71 and a corrugated engagement section 23 are provided.

[0143] Note that elements in the third embodiment that serve functions similar to those in the second embodiment are denoted by the same numbers, and description thereof is omitted.

[0144] As illustrated in Fig. 19, the packaging body 1b according to the third embodiment is such that the longitudinal end portions 15a of the base beams 15 project away from the corrugated engagement sections 23 beyond the corrugated engagement sections 23 in the X direction. Note that the packaging body 1b has corrugated engagement sections 23 on the front surface and back surface of the packaging body 1b, and the longitudinal end portions 15a of the base beams 15 project away from both corrugated engagement sections 23. The end portions 15a of the base beams 15 illustrated in Fig. 19 are end portions closer to the front side of the shipping container 2 in the X direction, and project in the X direction toward the front side of the shipping container 2 toward the back side. Incidentally, though not illustrated, the end portions 15a closer to the back side of the shipping container 2 project in the X direction toward the back side of the shipping container 2 from the front side beyond the corrugated engagement sections 23.

[0145] The base beams 15 include the convexities 71 on the upper surfaces of the portions projecting beyond the corrugated engagement sections 23 in the X direction. In Fig. 19, a cuboidal shape is exemplarily illustrated as the outer shape of the convexities 71. At least one convexity 71 may be sufficient. Fig. 19 exemplarily illustrates a structure in which the convexities 71 are not provided on the base beams 15 at the opposite ends in the Y direction, and a convexity 71 is provided on each of the three base beams 15 other than those at the opposite ends, so that three convexities 71 are provided in total.

[0146] Also, the packaging body 1b according to the third embodiment includes the engagement jig 73. The engagement jig 73 is a block-shaped member that protects a corrugated engagement section 23 by engaging the corrugated engagement section 23, and includes a jig-side corrugated engagement section 75, a flat surface section 77, and concavities 79. The engagement jig 73 in Fig. 19 has a block shape extending in the Y direction.

[0147] The jig-side corrugated engagement section 75 is a corrugated section that engages a corrugated engagement section 23, and is provided on one of the side surfaces of the packaging body 1b. In Fig. 19, the corrugated engagement section 23 is provided on the back surface as viewed from the door 12 of the shipping container 2 toward its back, and its wave direction is oriented in the Y direction, which is the width direction of the shipping container 2, in plan view. The dimensions and shapes of the jig-side corrugated engagement section 75 such as its waveform, wavelength, and amplitude are the same as those of the corrugated engagement section 23. In this way, the jig-side corrugated engagement section 75 can engage a corrugated engagement section 23. Nonetheless, the height in the Z direction may be greater or less than the upper end of the corrugated engagement section 23 in the Z direction. Moreover, the jig-side corrugated engagement section 75 does not need to engage all waves forming the corrugated engagement section 23.

[0148] The flat surface section 77 is a surface opposed to the side surface where the jig-side corrugated engagement section 75 is provided and, in Fig. 19, is provided on the front surface as viewed from the door 12 of the shipping container 2 toward it back. The flat surface section 77 is a flat surface and is therefore a surface parallel to the Y-Z plane.

[0149] The concavities 79 are dents to be fit to the convexities 71 and provided in the bottom surface of the jig-side corrugated engagement section 75. The shape and dimensions of the concavities 79 are such a shape and dimensions that the concavities 79 can be fitted to the convexities 71. Specifically, the concavities 79 have an inner surface shape that is the same as the outer shape of the convexities 71, and the dimensions are substantially the same as well. In Fig. 19, the convexities 71 are cuboidal, and therefore the inner surface shape of the concavities 79 is cuboidal as well.

[0150] At least the same number of concavities 79 as the convexities 71 is required. Also, since the convexities 71 are to be fitted to the concavities 79, the positional relationships between the concavities 79 such as the distances between them in the X and Y directions are the same as the positional relationships between the convexities 71 in the X and Y directions. Specifically, in the state where the jig-side corrugated engagement section 75 and the corrugated engagement section 23 are engaged, the concavities 79 and the convexities 71 are in such a positional relationship that their positions in plan view coincide with each other.

[0151] With this structure, by moving the engagement jig 73 downward with the concavities 79 located above the convexities 71 as illustrated in Fig. 19 to engage the corrugated engagement section 23 and the jig-side corrugated engagement section 75 and fit the convexities 71 to the concavities 79, the engagement jig 73 is fixed to the packaging body 1b as illustrated in Fig. 20. In this state, as illustrated in Fig. 20, the engagement jig 73 covers the corrugated engagement section 23. Incidentally, in the state illustrated in Fig. 20, a wire coil 6 can be loaded on the packaging body 1b with the engagement jig 73 fixed thereto, and the packaging body 1b can be handled with a forklift or the like.

[0152] The reason why there are provided corrugated engagement sections 23 and a corrugated engagement section 23 may be covered with the engagement jig 73 as describe above, and the reason for making the base beams 15 project beyond the corrugated engagement sections 23 in the X direction will now be described.

[0153] The corrugated engagement sections 23 are members that engage corrugated engagement sections 23 of other packaging bodies 1b to restrict relative movement of the engaged packaging bodies 1b in the Y direction.

[0154] Here, as illustrated in Fig. 21, of packaging bodies 1b loaded in the shipping container 2, packaging bodies 1b in contact with the door 12 and the back wall 10 are such that their corrugated engagement sections 23 facing the door 12 and the back wall 10 are not engaged with others' corrugated engagement sections 23. The corrugated engagement sections 23 not engaged with others' corrugated engagement sections 23 do not exert the function of restricting movement in the Y direction, and also the corrugated engagement sections 23 may collide with the door 12 and the back wall 10 and break their waves.

[0155] Thus, the corrugated engagement sections 23 facing the door 12 and the back wall 10 can be protected from the door 12 and the back wall 10 by covering each corrugated engagement section 23 with the engagement jig 73 as illustrated in Fig. 21. Specifically, by covering each of the corrugated engagement sections 23 facing the door 12 and the back wall 10 with the engagement jig 73, the flat surface sections 77 of the engagements jigs 73 face the door 12 and the back wall 10. The flat surface sections 77 are surfaces parallel to the Y-Z plane and therefore face the inner surfaces of the door 12 and the back wall 10 in parallel to one another. In this way, the corrugated engagement sections 23 will not break even if the flat surface sections 77 contact the door 12 and the back wall 10.

[0156] Also, in Fig. 21, all packaging bodies 1b loaded in the shipping container 2 include corrugated engagement

sections 23. However, cargo loaded in a single shipping container 2 is not always wire coils 6 with the same dimensions. Thus, not all cargo supporting structures, such as mounts and packaging bodies, loaded in the shipping container 2 are necessarily provided with corrugated engagement sections 23. For instance, Fig. 22 illustrates an example in which two packaging bodies 1b and one coil mount 91 are loaded in one shipping container 2. The coil mount 91 is disposed in the shipping container 2 so as to be sandwiched in the X direction, and a coiled object 81 having different dimensions from those of the wire coils 6 is loaded thereon. The coiled object 81 is a sheet steel coil, for example. Unlike the packaging bodies 1b, the coil mount 91 for loading the coiled object 81 is not provided with corrugated engagement sections 23. When the coil mount 91 without corrugated engagement sections 23 and the packaging bodies 1b with corrugated engagement sections 23 are loaded together in a single shipping container 2 as described above, the corrugated engagement sections 23 facing the coil mount 91 cannot engage the coil mount 91. Also, the corrugated engagement sections 23 facing the coil mount 91 may collide with the coil mount 91 and break their waves.

[0157] For this reason, by covering each corrugated engagement section 23 facing the coil mount 91 with the engagement jig 73 as illustrated in Fig. 22, the corrugated engagement section 23 can be protected from the mount without corrugated engagement sections 23, such as the coil mount 91.

[0158] Also, in the case where the base beams 15 project beyond the corrugated engagement sections 23 in the X direction, projecting portions of the base beams 15 of packaging bodies 1b adjacent in the X direction face each other in the Y direction in a state where corrugated engagement sections 23 of the packaging bodies 1b adjacent in the X direction are engaged with each other as illustrated in Fig. 21. For example, in Fig. 21, corrugated engagement sections 23 of a packaging bodies 1b-1 and 1b-2 adjacent in the X direction are engaged with each other, and base beams 15-1 of the packaging body 1b-1 and base beams 15-2 of the packaging body 1b-2 face and abut each other in the Y direction.

[0159] In this state, if the packaging body 1b-1 tries to move in a direction Y1, which is one direction along the Y direction, the packaging body 1b-1 is restricted from moving by the base beams 15-1 contacting the base beams 15-2 of the packaging body 1b-2. Conversely, if the packaging body 1b-2 tries to move in a direction Y2, which is one direction along the Y direction and opposite to the direction Y1, the packaging body 1b-2 is restricted from moving by the base beams 15-2 contacting the base beams 15-1 of the packaging body 1b-1. Thus, not only the corrugated engagement sections 23 but also the base beams 15 restrict movement of the packaging bodies 1b in the Y direction. The directions Y1 and Y2 are directions in which the base beams 15-1 and 15-2 may get closer to each other in the Y direction.

[0160] As described above, by making the base beams 15 project beyond the corrugated engagement sections 23 in the X direction, the base beams 15 can also restrict movement of the packaging body 1b in the Y direction.

[0161] Note that the positions of the base beams 15 in the Y direction are preferably such positions that, in a state where the corrugated engagement sections 23 are engaged with corrugated engagement sections 23 of other packaging bodies 1b, the base beams 15 abut the base beams 15 of the other packaging bodies 1b with the engaged corrugated engagement sections 23 in the Y direction, which is the width direction of the shipping container 2. For example, in Fig. 21, a corrugated engagement section 23 of the packaging body 1b-1 and a corrugated engagement section 23 of the packaging body 1b-2 are engaged with each other, and the base beams 15-1 of the packaging body 1b-1 and the base beams 15-2 of the packaging body 1b-2 abut each other in the Y direction. With this configuration, when corrugated engagement sections 23 of two packaging bodies 1b are engaged with each other, their base beams 15 abut each other in the Y direction, thereby restraining movement in the directions in which the base beams 15 may get closer to each other in the Y direction.

[0162] Moreover, the positions of the base beams 15 of the packaging body 1b in the Y direction are preferably such positions that, in a state where the base beams 15 abut the base beams 15 of another packaging body 1b in the Y direction, which is the width direction of the shipping container 2, the packaging body 1b abuts a sidewall of the shipping container 2 in the direction opposite to the direction in which the base beams 15 abut each other.

[0163] For example, in Fig. 21, a corrugated engagement section 23 of the packaging body 1b-1 and a corrugated engagement section 23 of the packaging body 1b-2 are engaged with each other, and the packaging body 1b-1 abuts a sidewall 5a of the shipping container 2 in the direction Y2 opposite to the direction Y1, in which the base beams 15-1 abut the base beams 15-2 of the packaging body 1b-2.

[0164] On the other hand, the packaging body 1b-2 abuts a sidewall 5b of the shipping container 2 in the direction Y1 opposite to the direction Y2, in which the base beams 15-2 abut the base beams 15-1 of the packaging body 1b-1. With this configuration, when the packaging body 1b-1 tries to move in the direction Y2, the sidewall 5a of the shipping container 2 prevents the movement since the packaging body 1b-1 abuts the sidewall 5a. On the other hand, when the packaging body 1b-2 tries to move in the direction Y1, the sidewall 5b of the shipping container 2 prevents the movement since the packaging body 1b-2 abuts the sidewall 5b. Accordingly, it is possible to restrict movement in both directions along the Y direction.

[0165] Incidentally, as illustrated in Fig. 23, when packaging bodies 1c of the same type are loaded in the shipping container 2, their corrugated engagement sections 23 may also be covered with the engagement jigs 73. There are two reasons for this.

[0166] Now, the first reason is that the shipping container 2 may be provided in advance with members that guide the

base beams 15 in the X direction while restricting movement in the Y direction, such as rails that serve as guides for movement in the X direction. In this case, the packaging bodies 1c do not need to have members that allow positioning while restricting movement in the Y direction, like the corrugated engagement sections 23, and engaging the corrugated engagement sections 23 may conversely result in misalignment between positions of the base beams 15 and the rails.

In this case too, the corrugated engagement sections 23 need to be covered with the engagement jigs 73 when the packaging bodies 1c are loaded in the shipping container 2. Thus, even when the shipping container 2 is provided with members that guide movement of the packaging bodies 1c, covering the corrugated engagement sections 23 with the engagement jigs 73 will prevent the corrugated engagement sections 23 from obstructing the guidance of the guide members.

[0167] Next, there is a case where it is not desired to bring the base beams 15 of packaging bodies 1c into contact with each other when their corrugated engagement sections 23 are engaged with each other.

[0168] Depending on the length of the base beams 15, the base beams 15-1 of the packaging body 1b-1 and the base beams 15-2 of the packaging body 1b-2 may abut each other in the Y direction, as illustrated in Fig. 21, when a corrugated engagement section 23 of the packaging body 1b-1 and a corrugated engagement section 23 of the packaging body 1b-2 are engaged with each other. While this structure is effective in preventing the packaging bodies 1b-1 and 1b-2 from moving in the Y direction, the base beams 15 do not need to restrict movement of the packaging bodies 1c in the Y direction in the case where the shipping container 2 is provided with members that guide movement of the packaging bodies 1c. Also, when the base beams 15 abut each other in the Y direction, the loads applied from the packaging bodies 1c concentrate on the container floor surface under the abutting portions. This increases the burden on the beams supporting the container floor surface. For this reason, it is sometimes preferable not to bring the base beams 15 into abutment with each other in the Y direction in the case of using a shipping container 2 whose beams have degraded due to aging or the like.

[0169] Then, as illustrated in Fig. 23, by covering the corrugated engagement sections 23 with the engagement jigs 73, the engagement jigs 73 on adjacent packaging bodies 1c contact each other, thereby separating their base beams 15 in the X direction. In this state, the base beams 15 do not abut each other in the Y direction. Incidentally, to prevent the base beams 15 from abutting each other in the Y direction, the lengths of the base beams 15 needs to be such that they do not project beyond the engagement jigs 73 in the X direction in the state where the corrugated engagement sections 23 are covered with the engagement jigs 73. More specifically, the base beams 15 only need to be such that the positions of the longitudinal end portions 15a of the base beams 15 and the engagement jigs 73 in plan view overlap in the state where the jig-side corrugated engagement sections 75 of the engagement jigs 73 are engaged with the corrugated engagement sections 23 and the convexities 71 are fitted to the concavities 79.

[0170] While the present invention has been described above based on embodiments, the present invention is not limited to the embodiments. Those skilled in the art can naturally arrive at various modifications and improvements within the scope of the technical idea of the present invention, and these are also included in the present invention.

EXPLANATION OF REFERENCE NUMERALS

[0171]

1, 1a, 1b, 1b-1, 1b-2, 1c, 1d	packaging body
2	shipping container
4	container floor surface
5	container sidewall
6	wire coil
10	back wall
12	door
15, 15-1, 15-2	base beam
15a	end portion
18	lashing belt
19	coil holding stand
19a, 19b	wedge member
20	beam cushioning member
21	recessed section
22	inclined surface
23	corrugated engagement section
23a	inclined portion
30	roll cushion
30a	cut

	30b	notch
	31a	long edge
	31b	short edge
	33	cross beam
5	35	flat section
	37	band
	54a	block groove portion
	55	inner shell block
	56a	tenon
10	56b	mortise
	57	lower inner shell block
	57a	lower coupling concavity
	57b	lower inclined portion
	58	outer shell block
15	58a	accommodation concavity
	59	upper inner shell block
	59a	upper coupling concavity
	59b	upper inclined portion
	61	coupling block
20	62a	inner-shell corrugated portion
	62b	outer-shell corrugated portion
	71	convexity
	73	engagement jig
	75	jig-side corrugated engagement section
25	79	concavity
	91	coil mount

Claims

- 30
1. A packaging body for a wire coil being a wire wound into a shape of a cylinder and tied with a band, the packaging body being for protecting the wire coil by holding the wire coil sideways such that an axis of the cylinder of the wire coil is oriented in a horizontal direction, a plurality of the packaging bodies being to be loaded in a single container, the packaging body comprising:

35

a plurality of base beams disposed on a floor surface of the container and extending in one direction from a door of the container toward a back thereof;

a cross beam disposed on the plurality of base beams so as to extend in a width direction of the container perpendicular to the one direction, and coupling the base beams; and

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a block-shaped coil holding stand provided on the cross beam and including a recessed section in which to accommodate the wire coil sideways with an axial direction of the cylinder oriented in the width direction of the container, the coil holding stand being a stand to which to lash the wire coil, wherein

the coil holding stand includes a corrugated engagement section on a front surface and a back surface as viewed from the door of the container toward the back thereof, a wave direction of the corrugated engagement section being oriented in the width direction of the container in plan view, the corrugated engagement section being configured to engage the corrugated engagement section of another one of the packaging bodies.

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 2. The packaging body for a wire coil according to claim 1, wherein the coil holding stand has two wedge members in a shape of a wedge having an inclined surface that supports the wire coil, and tips of the wedges abut each other to form a V-shaped groove section as the recessed section.

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 3. The packaging body for a wire coil according to claim 2, wherein the two wedge members are offset from each other in an extension direction of the cross beam by a length that is an odd multiple of a half wavelength of a wave on the corrugated engagement section, and are disposed inward of ends of the cross beam and the base beams in the extension direction of the cross beam.

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 4. The packaging body for a wire coil according to claim 2 or 3, wherein

the wedge members each include

an inner shell block provided on the cross beam, and
an outer shell block formed so as to cover the inner shell block and having a wedge shape as an outer
shape thereof, and

the inner shell block and the outer shell block are made of such materials that the outer shell block deforms to
a greater extent when the inner shell block and the outer shell block are pressed against each other.

5. The packaging body for a wire coil according to claim 4, comprising:

an inner-shell corrugated portion in a corrugated shape which is provided on an upper surface of the inner shell
block as viewed from the extension direction of the cross beam; and
an outer-shell corrugated portion in a corrugated shape which is provided on a surface of the outer shell block
to be in contact with the upper surface and engages the inner-shell corrugated portion.

6. The packaging body for a wire coil according to claim 4 or 5, wherein

the outer shell block includes a flat section on an upper surface thereof closer to ends of the base beams than
the inclined surface is, and
the flat section includes a block groove portion extending in the extension direction of the cross beam.

7. The packaging body for a wire coil according to any one of claims 4 to 6, comprising:

a tenon or mortise which is provided along a vertical direction on or in a vertical surface of the inner shell block
facing the corrugated engagement section; and
a mortise or tenon which is provided in or on an inner peripheral surface of the outer shell block facing the
vertical surface and engages the tenon or mortise.

8. The packaging body for a wire coil according to any one of claims 1 to 7, wherein longitudinal end portions of the
base beams project away from the corrugated engagement section in the one direction beyond the corrugated
engagement section.

9. The packaging body for a wire coil according to claim 8, wherein positions of the base beams in the width direction
of the container are set at such positions that, when the corrugated engagement section of the packaging body is
engaged with the corrugated engagement section of another one of the packaging bodies, the base beams abut
the base beams included in the engaged corrugated engagement section in the width direction of the container.

10. The packaging body for a wire coil according to claim 9, wherein the positions of the base beams in the width
direction of the container are such positions that, in a state where the base beams abut the base beams of another
one of the packaging bodies in the width direction of the container, the packaging body abuts a sidewall of the
container in a direction opposite to a direction in which the base beams abut the base beams of the another one of
the packaging bodies.

11. The packaging body for a wire coil according to claim 9 or 10, wherein the base beams include convexities on upper
surfaces of portions thereof projecting beyond the corrugated engagement section in the one direction.

12. The packaging body for a wire coil according to claim 11, comprising an engagement jig having a block shape, wherein

the engagement jig includes a jig-side corrugated engagement section on one side surface thereof, the jig-side
corrugated engagement section being a section which engages the corrugated engagement section,
a surface of the engagement jig opposed to the side surface where the jig-side corrugated engagement section
is provided is a flat surface, and
the engagement jig includes concavities in a bottom surface thereof which are to be fitted to the convexities.

13. The packaging body for a wire coil according to claim 12, wherein in a state where the jig-side corrugated engagement
section of the engagement jig is engaged with the corrugated engagement section and the convexities are fitted to
the concavities, positions of the longitudinal end portions of the base beams and the engagement jig in plan view

overlap each other.

14. The packaging body for a wire coil according to any one of claims 1 to 13, comprising

a pair of plate-shaped beam cushioning members fixed to opposite ends of the cross beam along the extension direction of the base beams, wherein the beam cushioning members are configured to abut the beam cushioning members or the cross beams of other ones of the packaging bodies.

15. The packaging body for a wire coil according to claim 14, wherein

a length of the pair of beam cushioning members in an extension direction thereof is less than a half of a length of the base beams, and the beam cushioning members are disposed to be point-symmetric in plan view at the opposite ends of the cross beam and one end of each of the base beams in the extension direction thereof opposed to the other.

16. The packaging body for a wire coil according to claim 14 or 15, comprising

a sheet-shaped roll cushion that protects the wire coil by being lashed to the wire coil in a state of covering at least an uppermost surface in a circumferential surface of the wire coil and part of opposite end surfaces of the wire coil from above, wherein the packaging body for a wire coil is configured such that opposite ends of the roll cushion covering the circumferential surface of the wire coil abut opposite ends of upper surfaces of the roll cushions on other ones of the packaging bodies, and sections of the roll cushion covering part of the opposite end surfaces of the wire coil abut the sections of other ones of the roll cushions covering part of the opposite end surfaces of the respective wire coils.

17. The packaging body for a wire coil according to claim 16, wherein

the roll cushion has a bellows shape having straight cuts provided at predetermined intervals as fold lines, a linear width of the roll cushion is greater than an axial length of the wire coil, and a plurality of notches are provided in opposite ends of the roll cushion.

18. A method for loading a wire coil into a container by using the packaging body according to claim 16 or 17, the method comprising:

a coil loading step of loading the wire coil on the coil holding stand with the circumferential surface of the wire coil lying sideways;

a coil lashing step of lashing the wire coil to the coil holding stand by passing a lashing belt through a hole portion of the cylinder of the wire coil, further passing the lashing belt through a gap between the coil holding stand and a container floor surface, and fastening the lashing belt into a loop;

a roll cushion lashing step of covering at least the uppermost surface in the circumferential surface of the wire coil and part of the opposite end surfaces of the wire coil from above with the roll cushion, and lashing the roll cushion to the wire coil with a lashing belt; and

a container loading step of loading a plurality of the packaging bodies having completed the roll cushion lashing step into the container such that the corrugated engagement sections face a front side and a back side, wherein the container loading step includes

a front-rear-direction fixing step of engaging the corrugated engagement sections of the packaging bodies adjacent in a front-rear-direction and also bringing the roll cushions on the packaging bodies into abutment with each other, and

a width-direction fixing step of pushing another one of the packaging bodies into a gap between the packaging bodies adjacent in the width direction of the packaging bodies adjacent in the width direction or a gap between the packaging body and the container while compressing the beam cushioning members and the roll cushion.

FIG.1

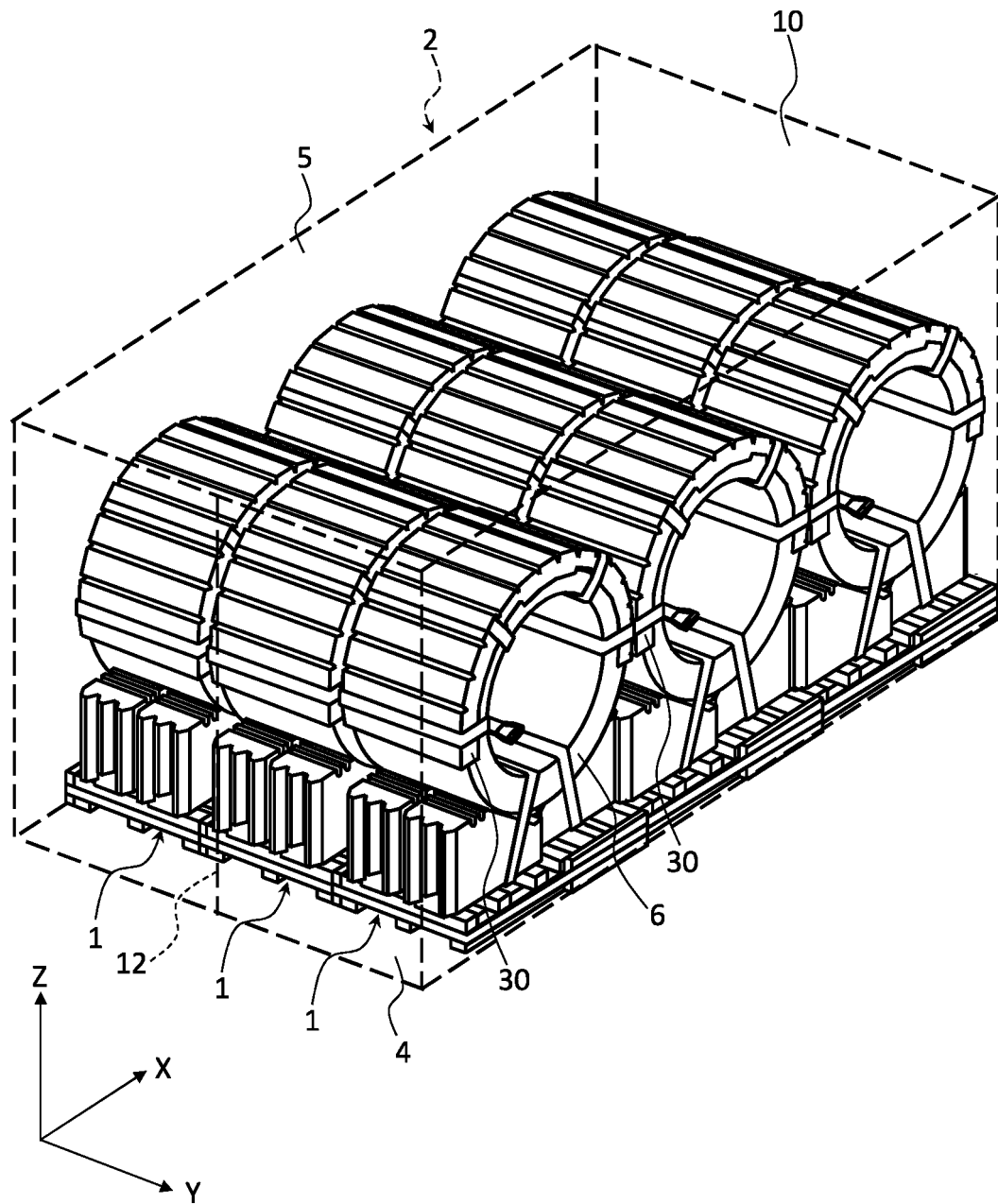


FIG.2

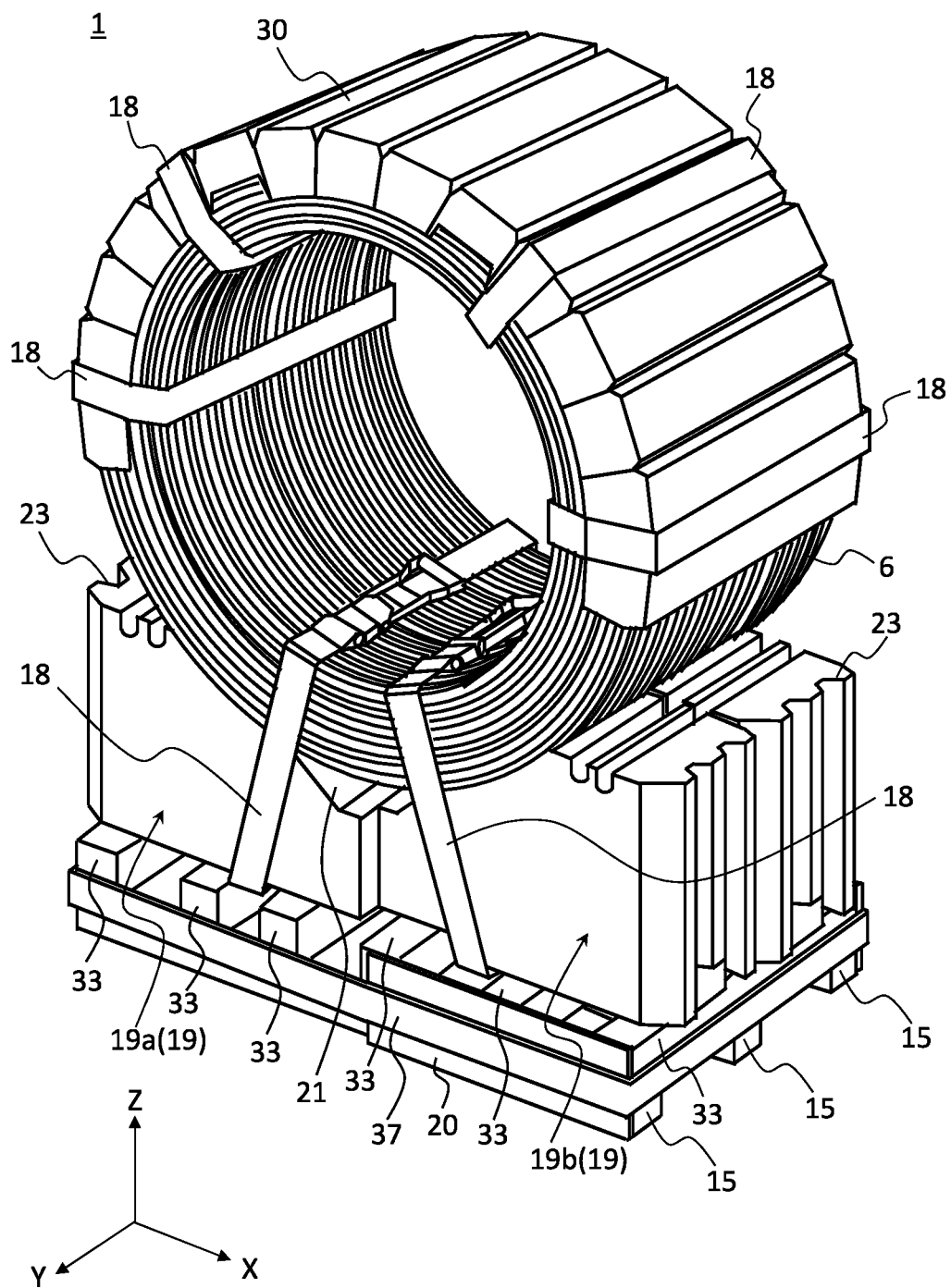


FIG.3

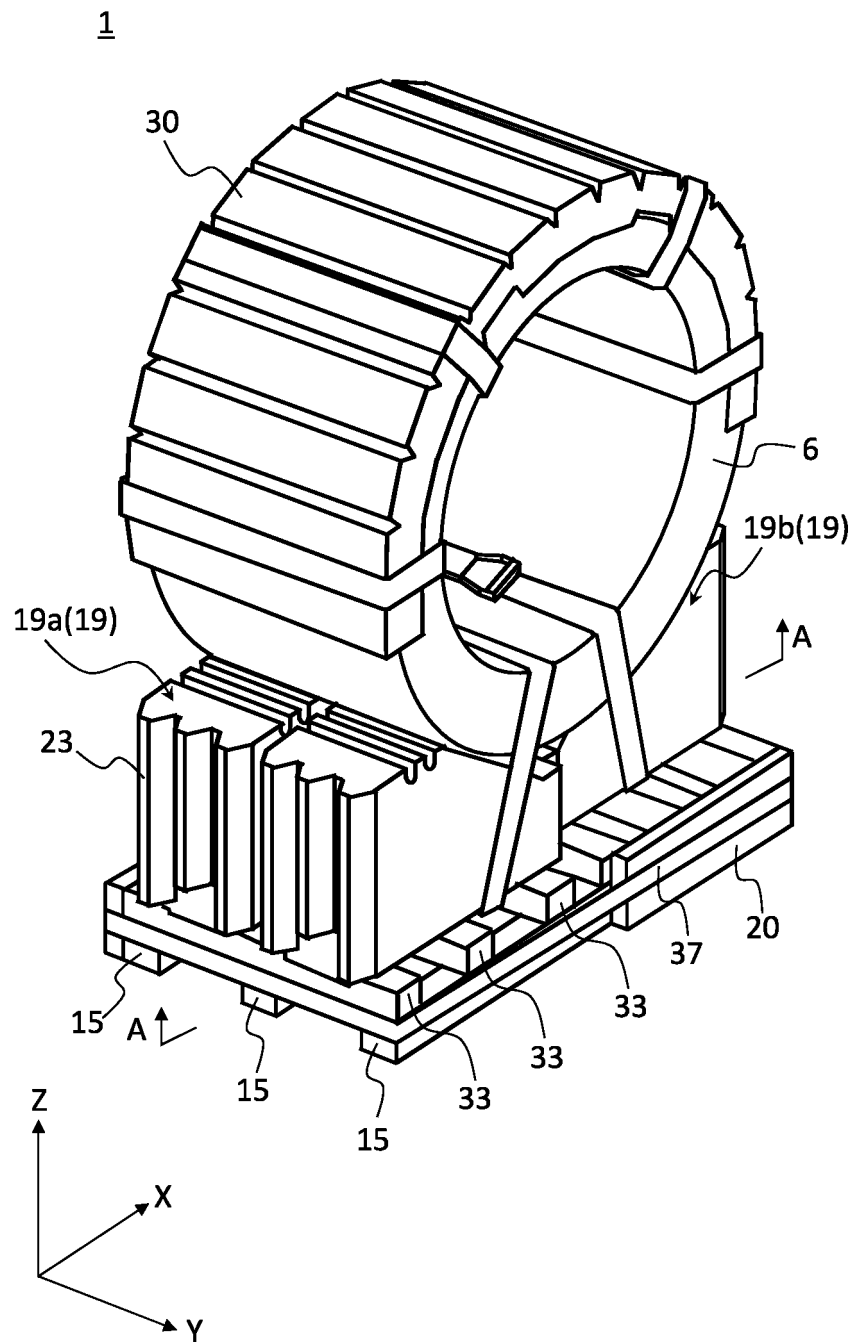


FIG.4

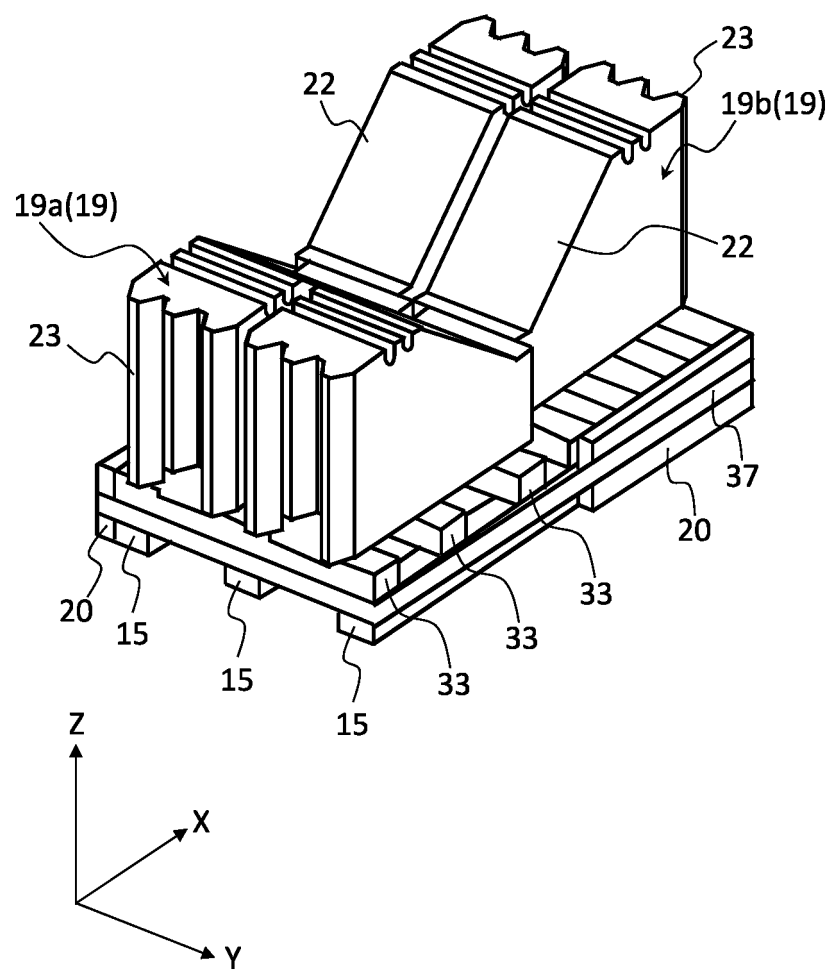


FIG.5

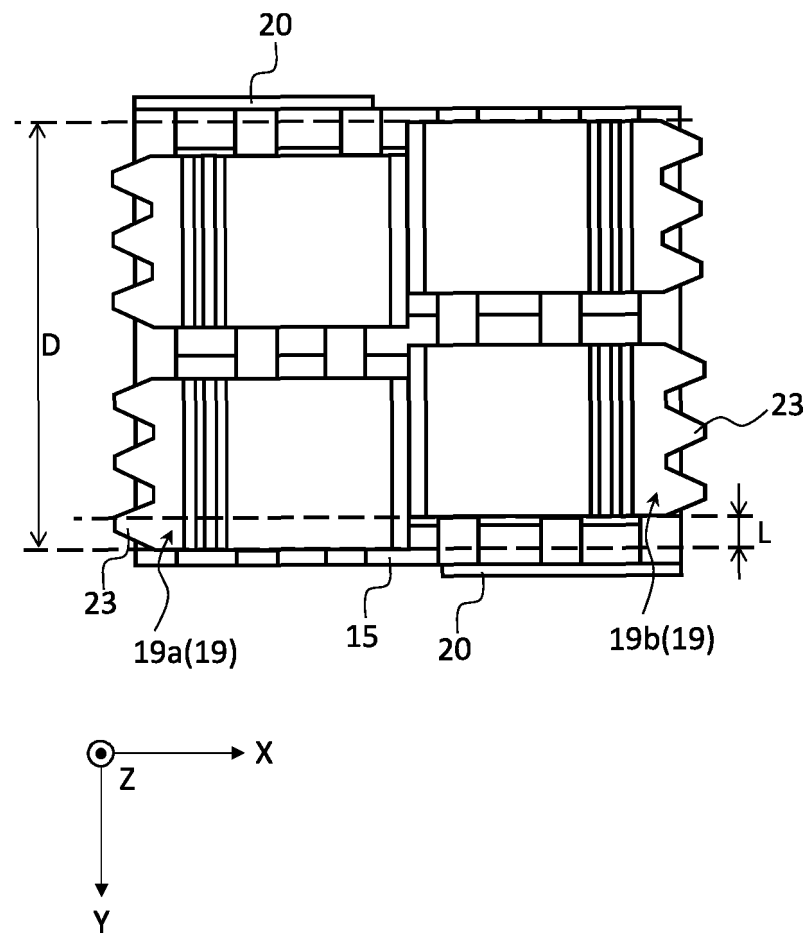


FIG.6

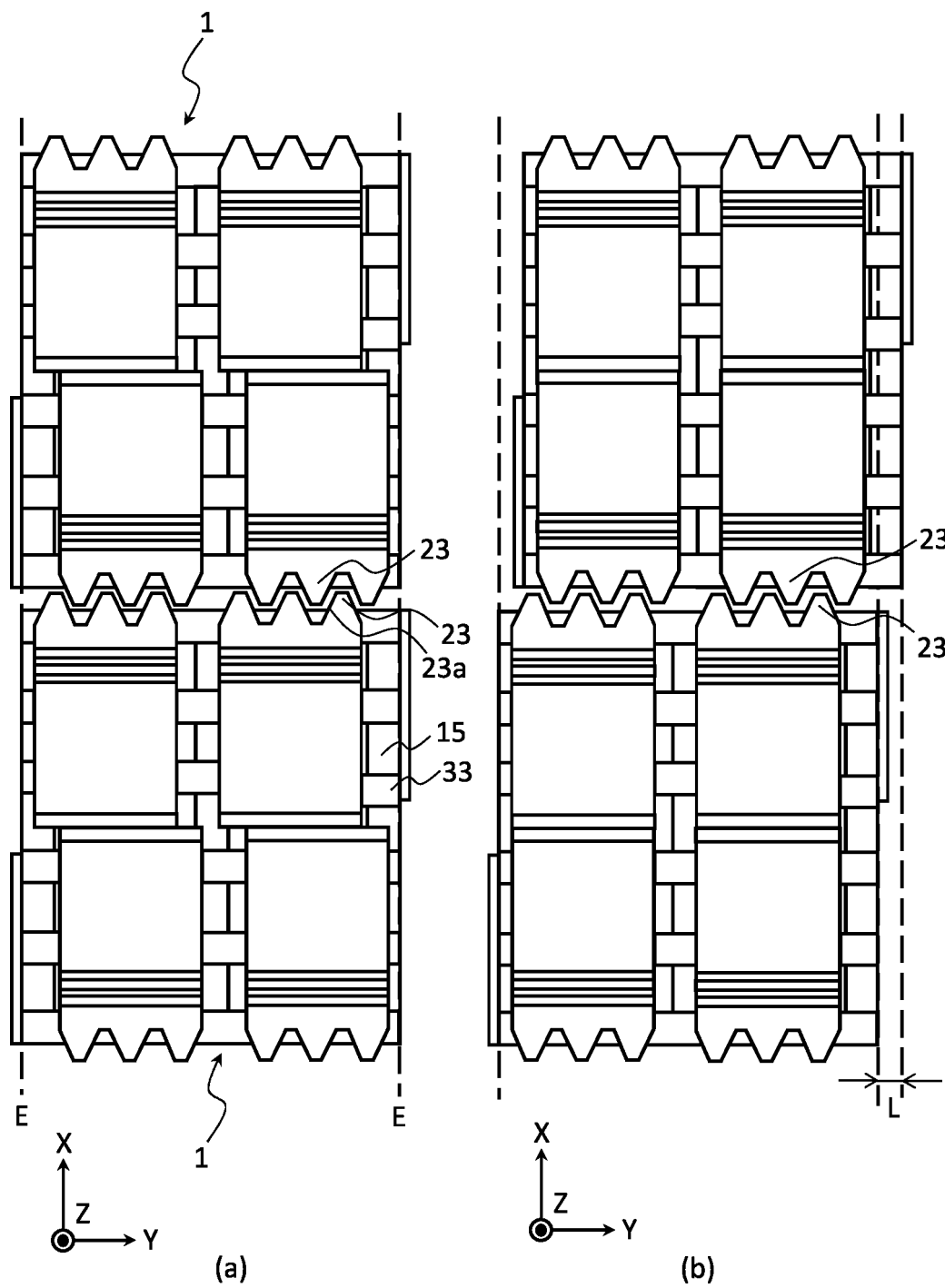


FIG.7

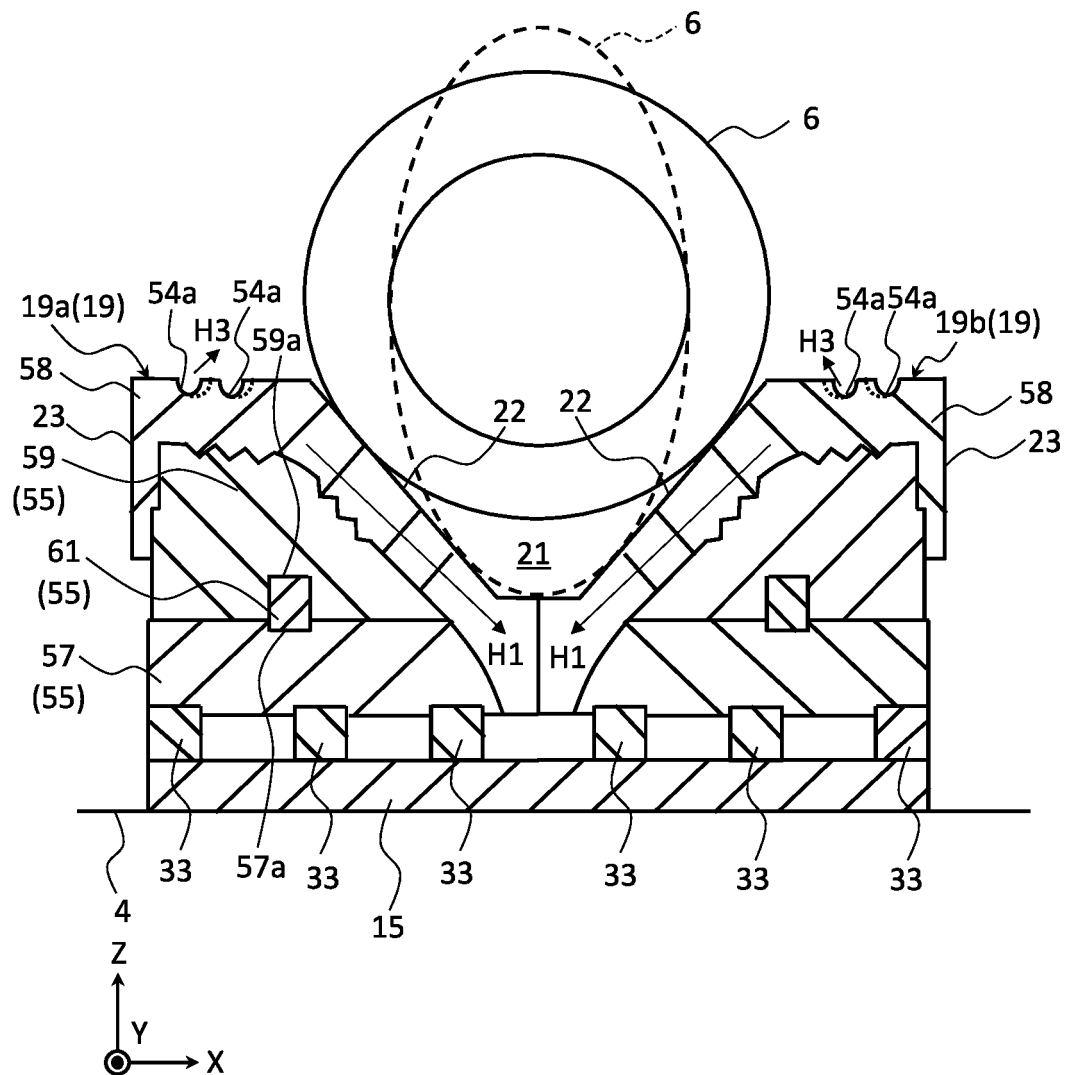


FIG.8

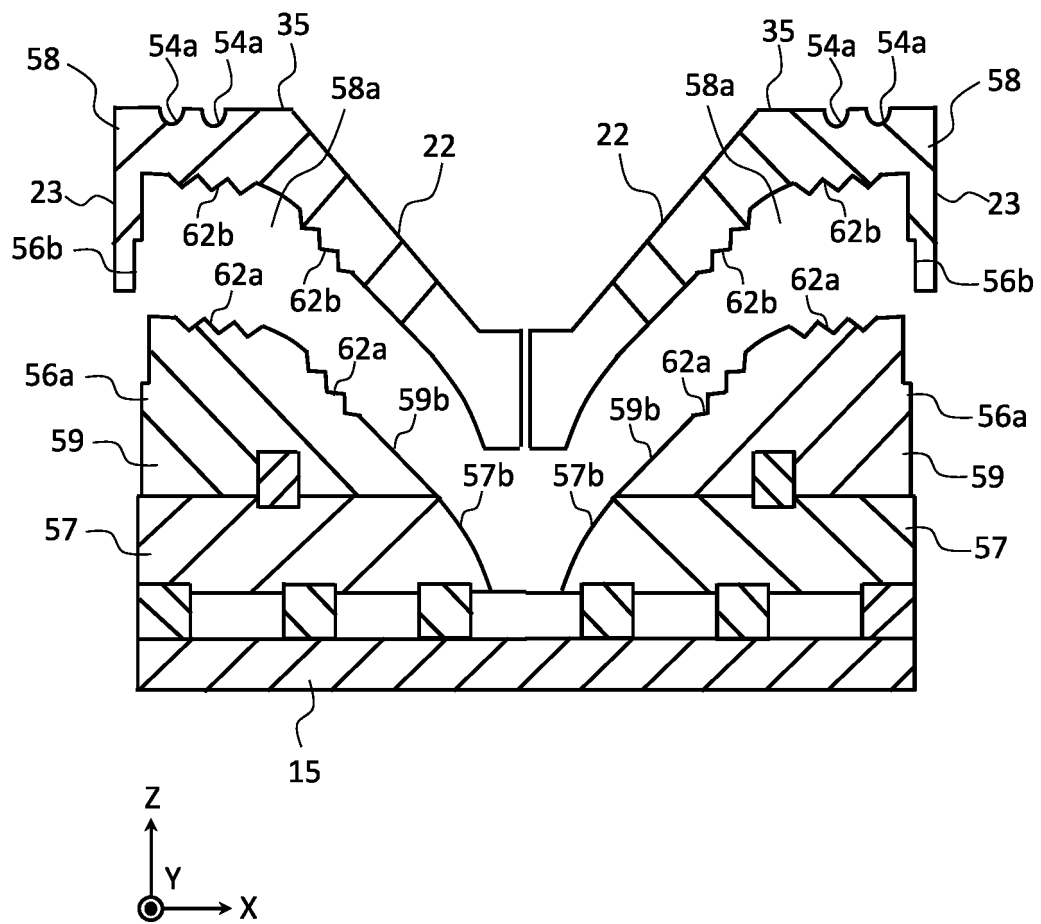


FIG.9

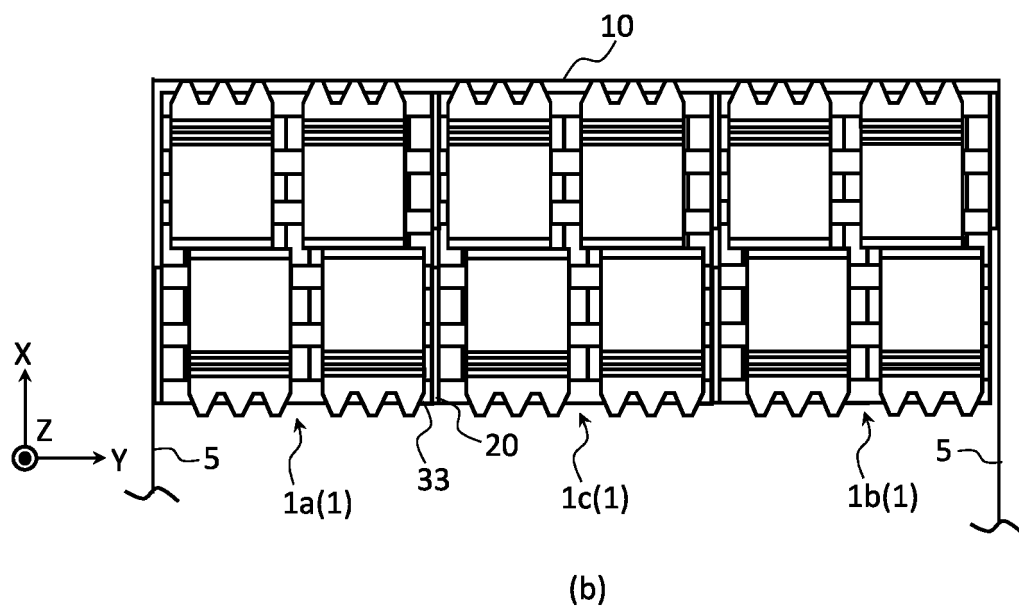
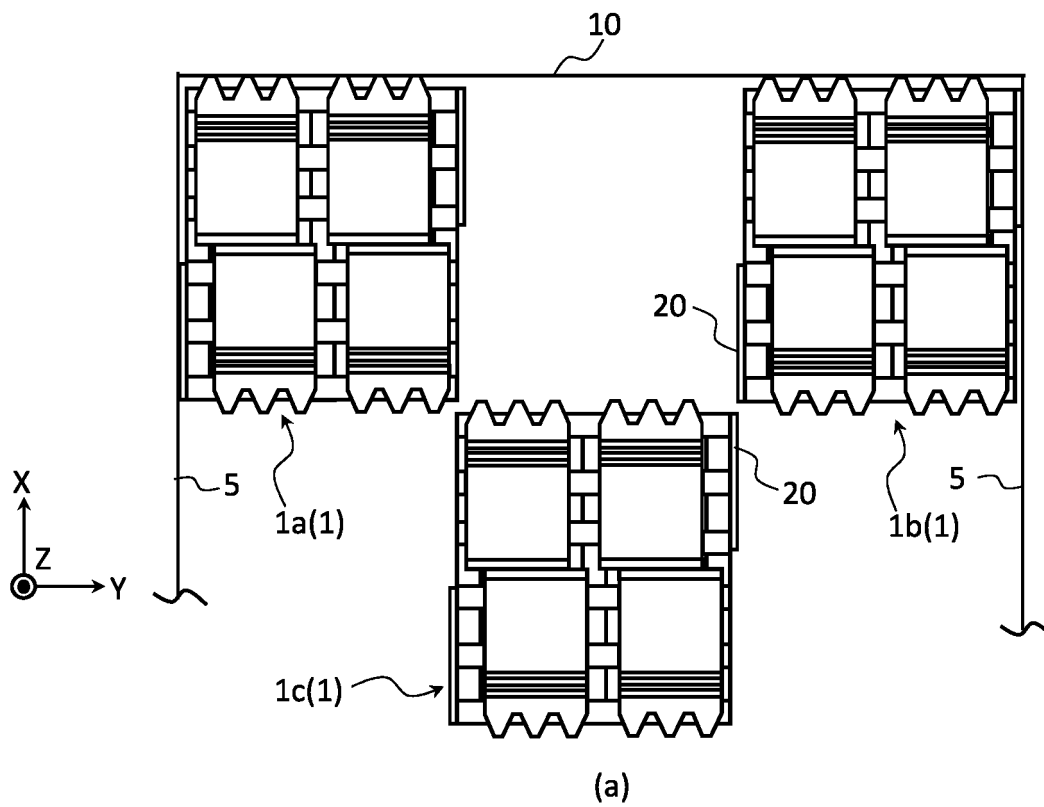


FIG.10

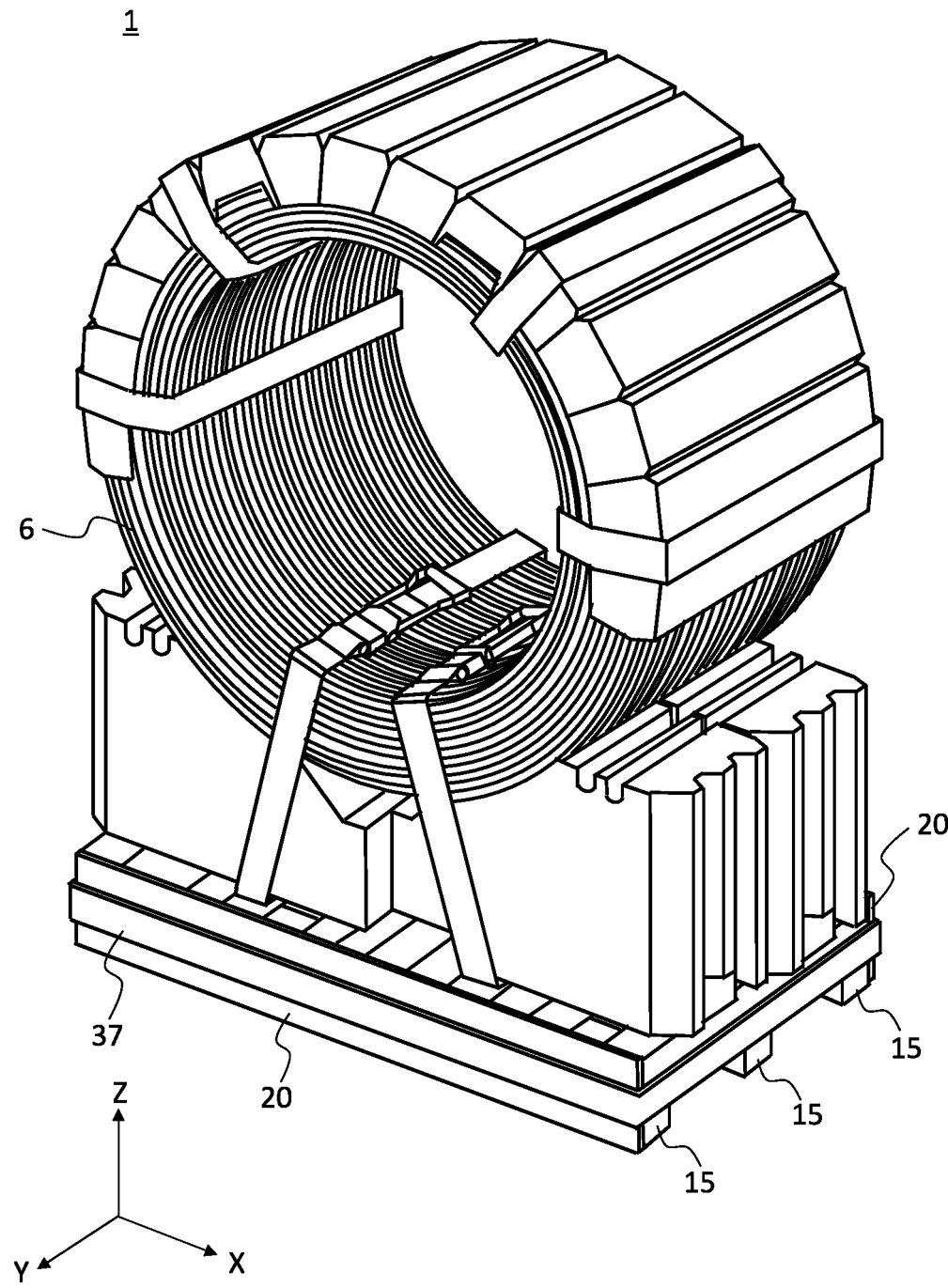


FIG.11

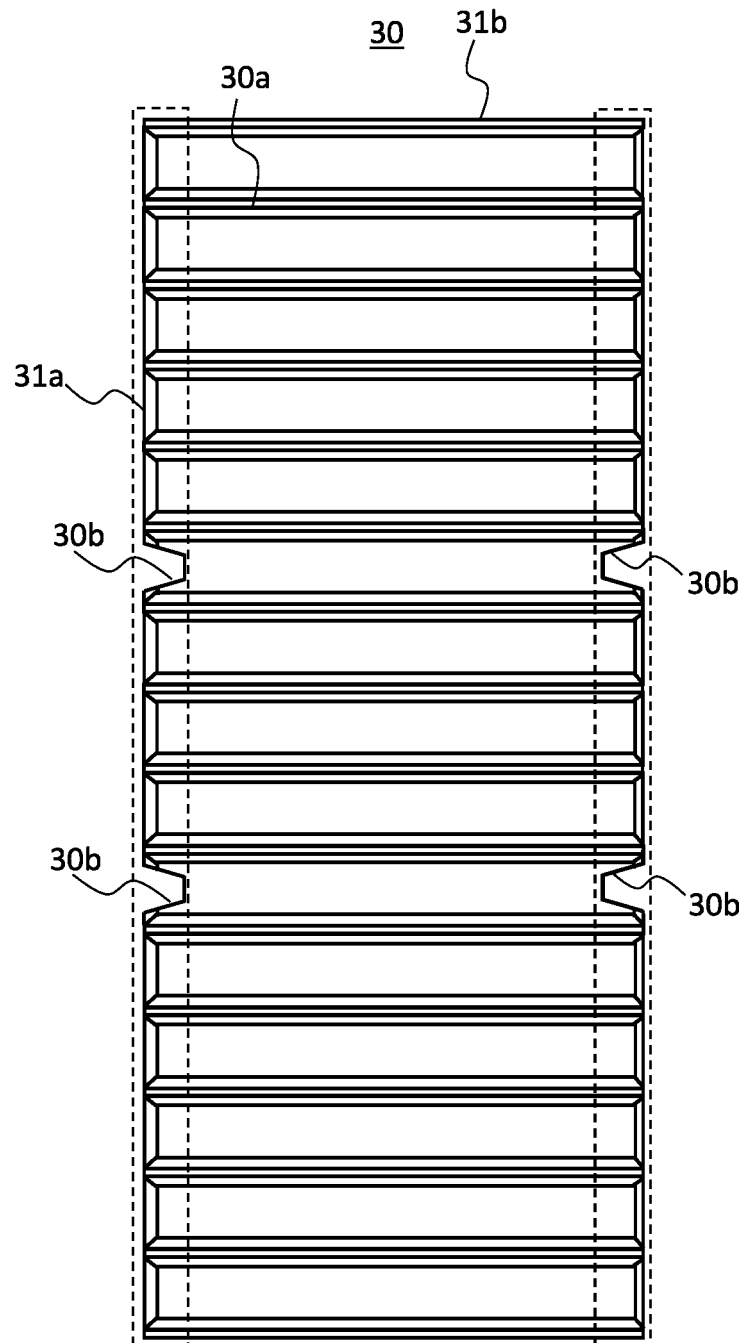


FIG.12

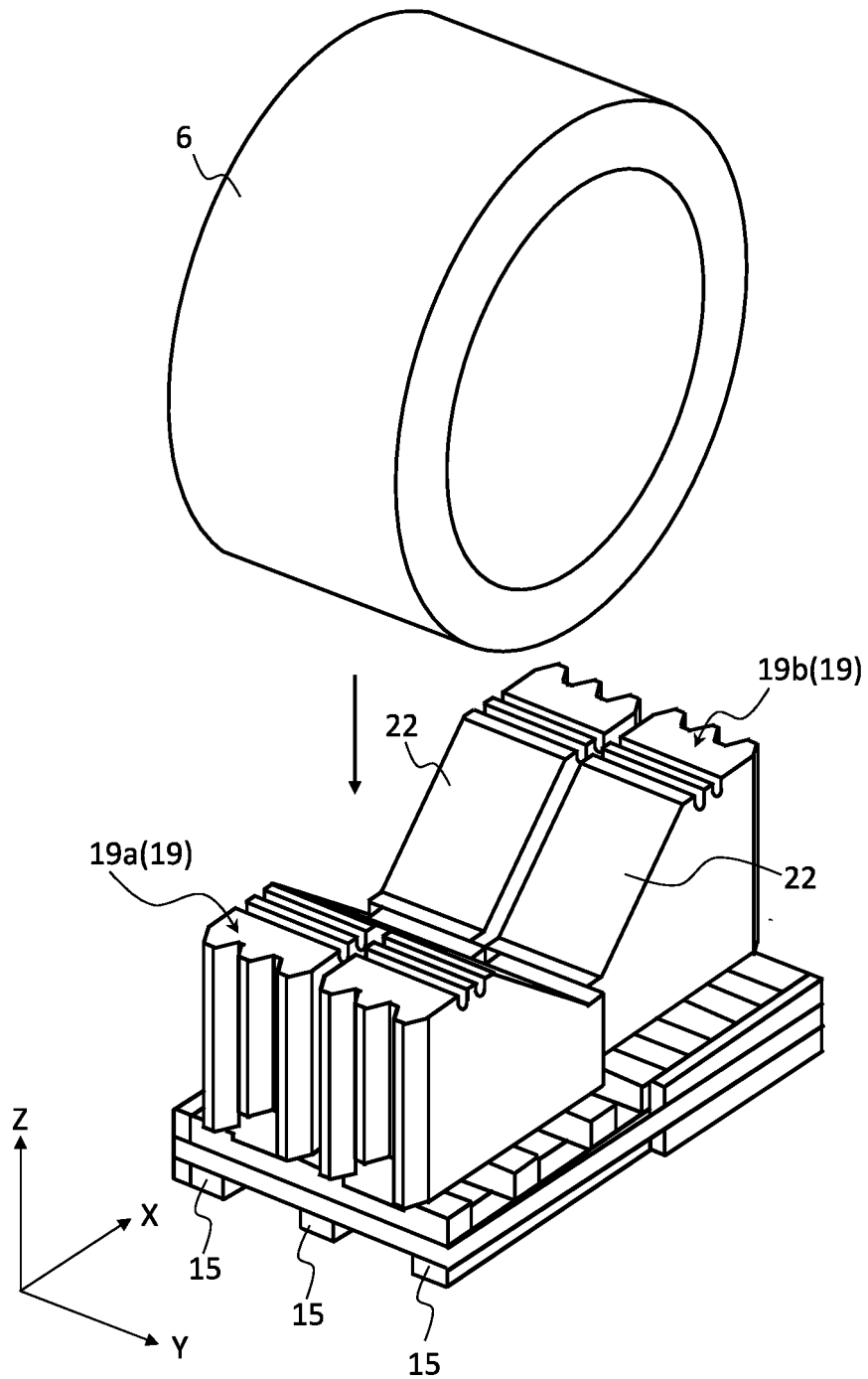


FIG.13

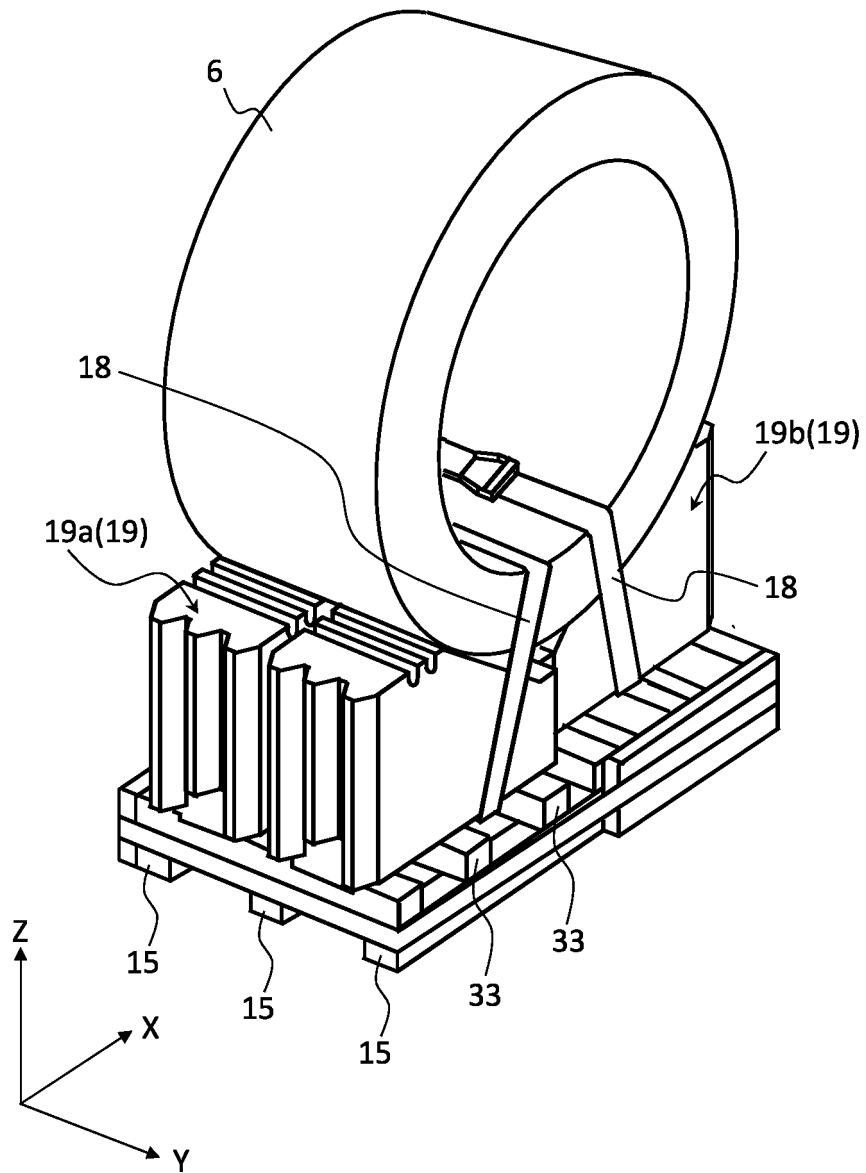


FIG.14

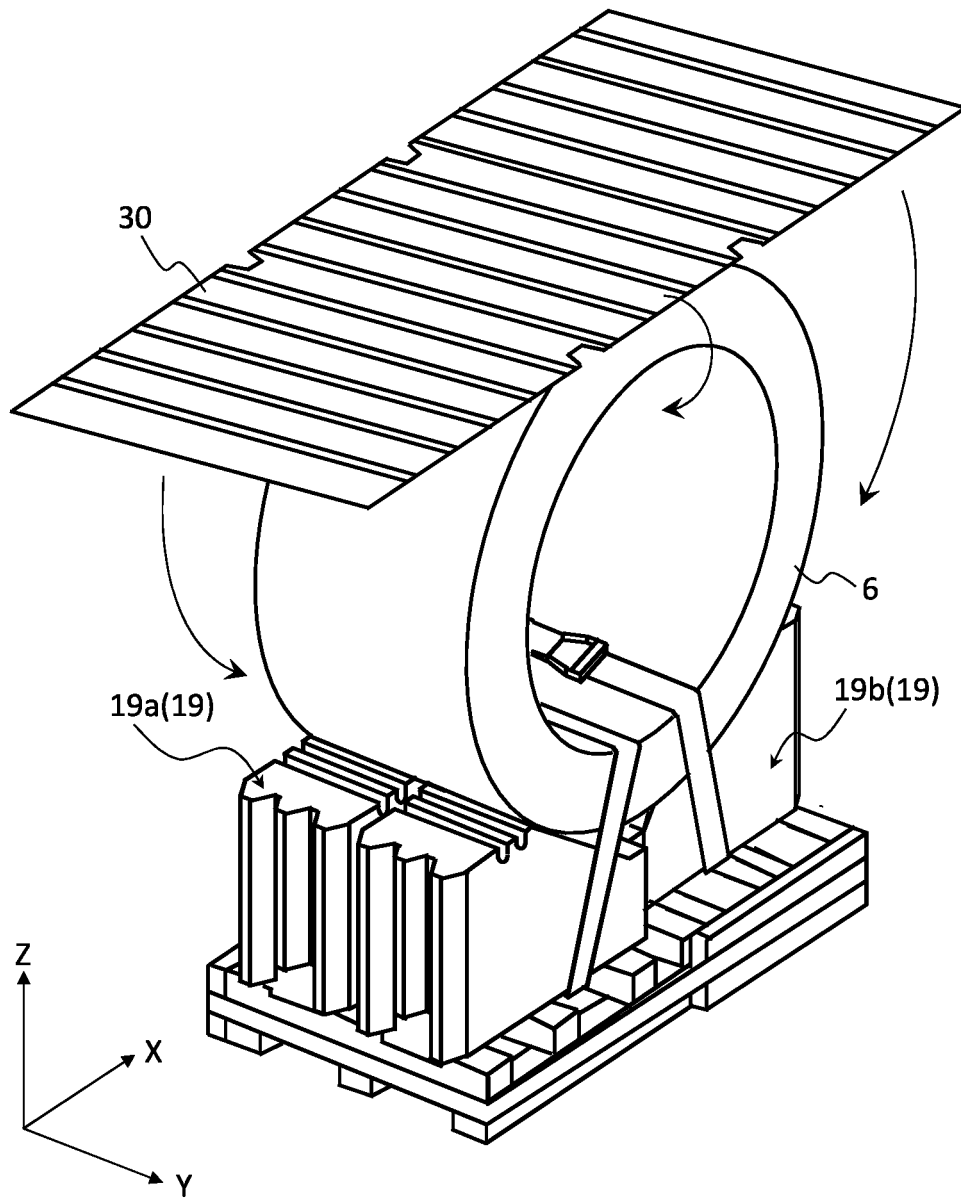


FIG.15

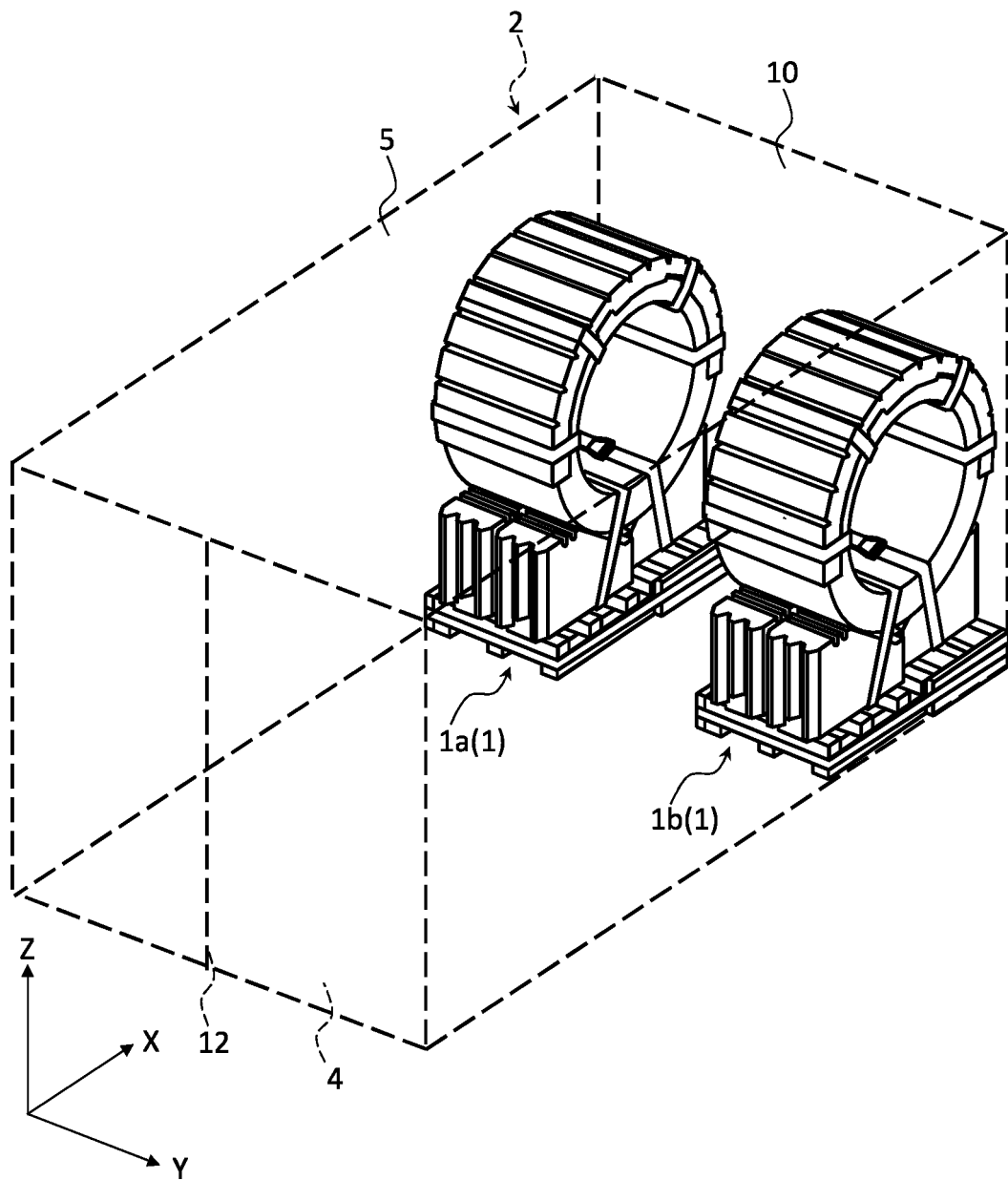


FIG.16

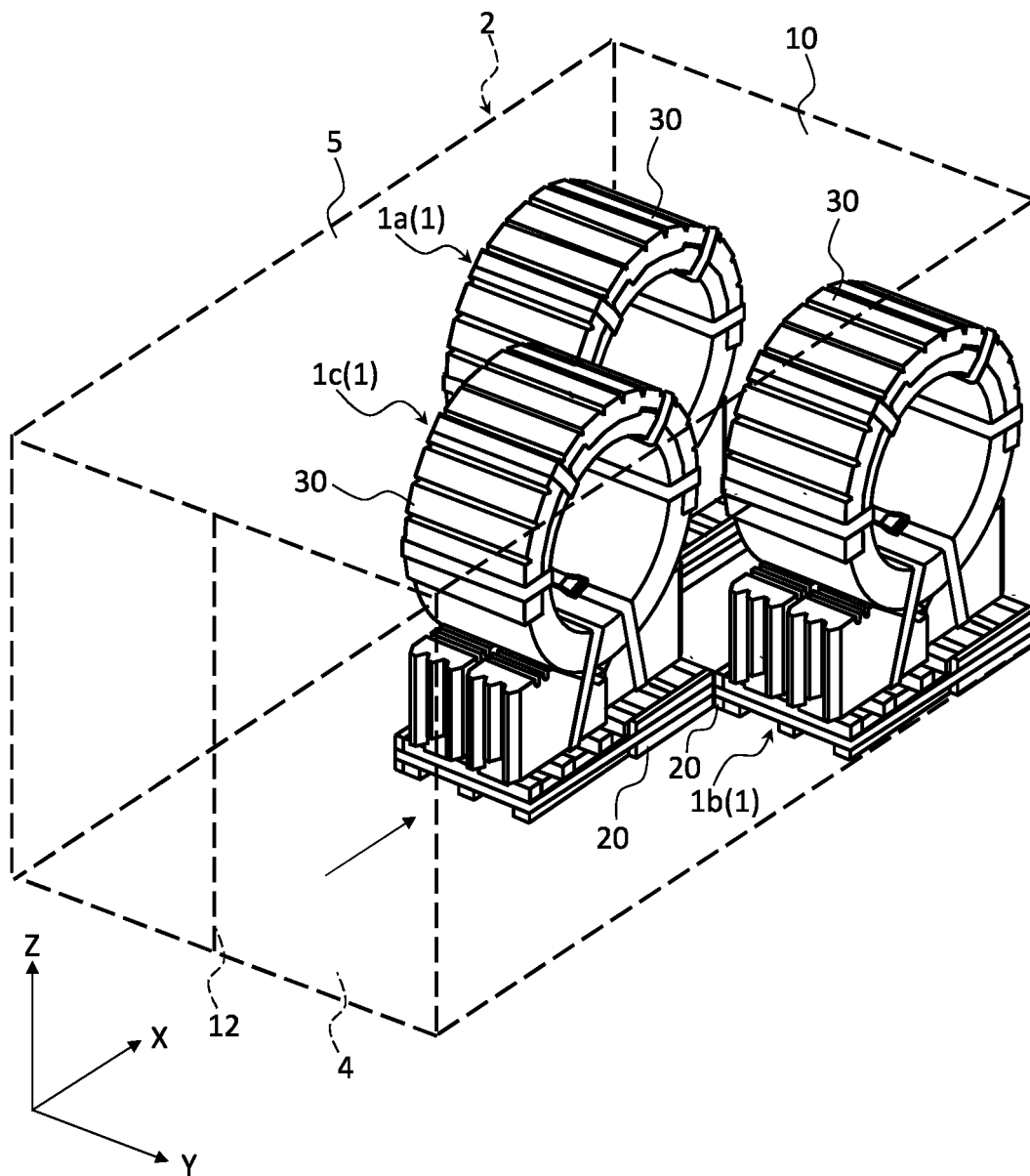


FIG.17

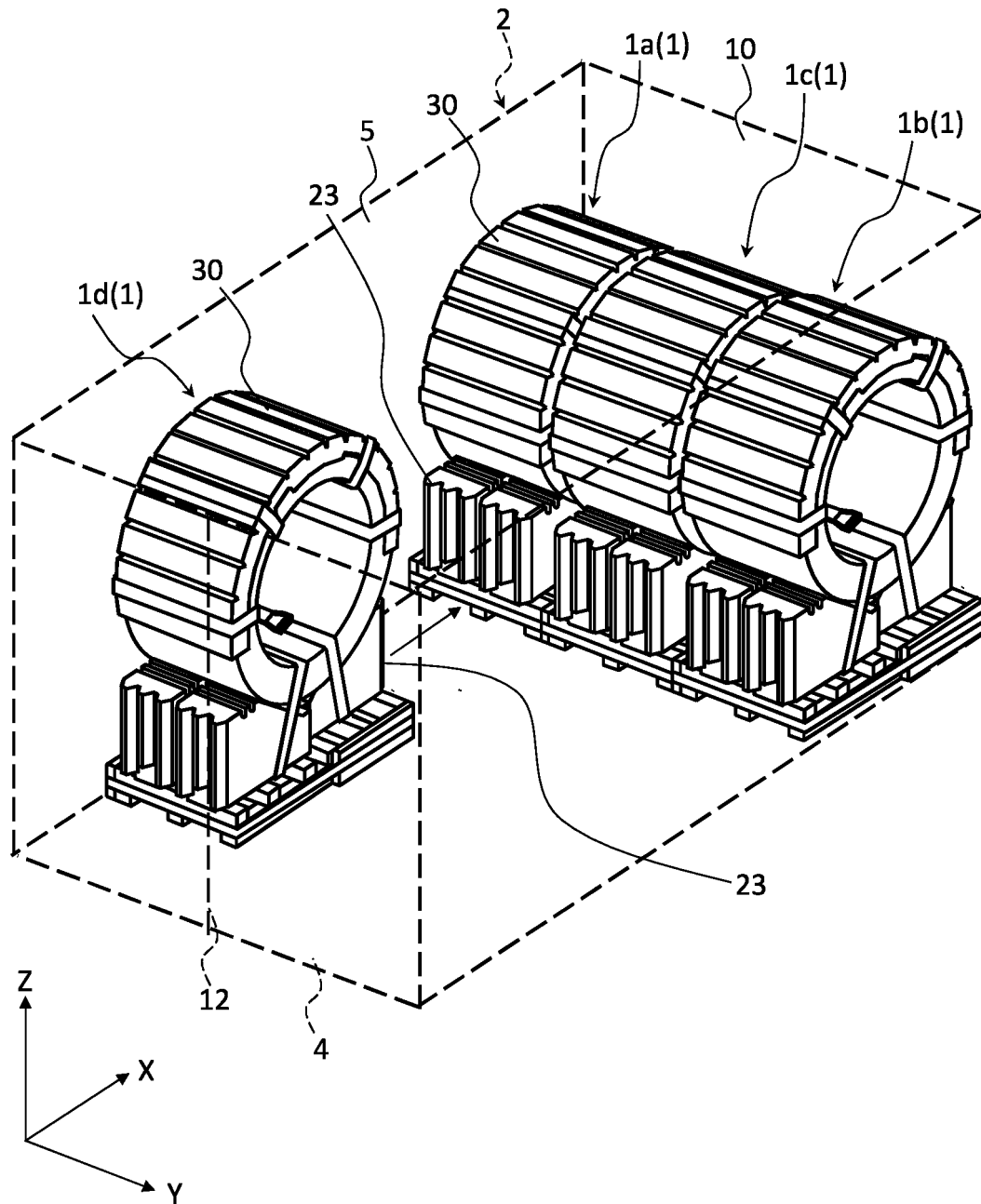


FIG.18

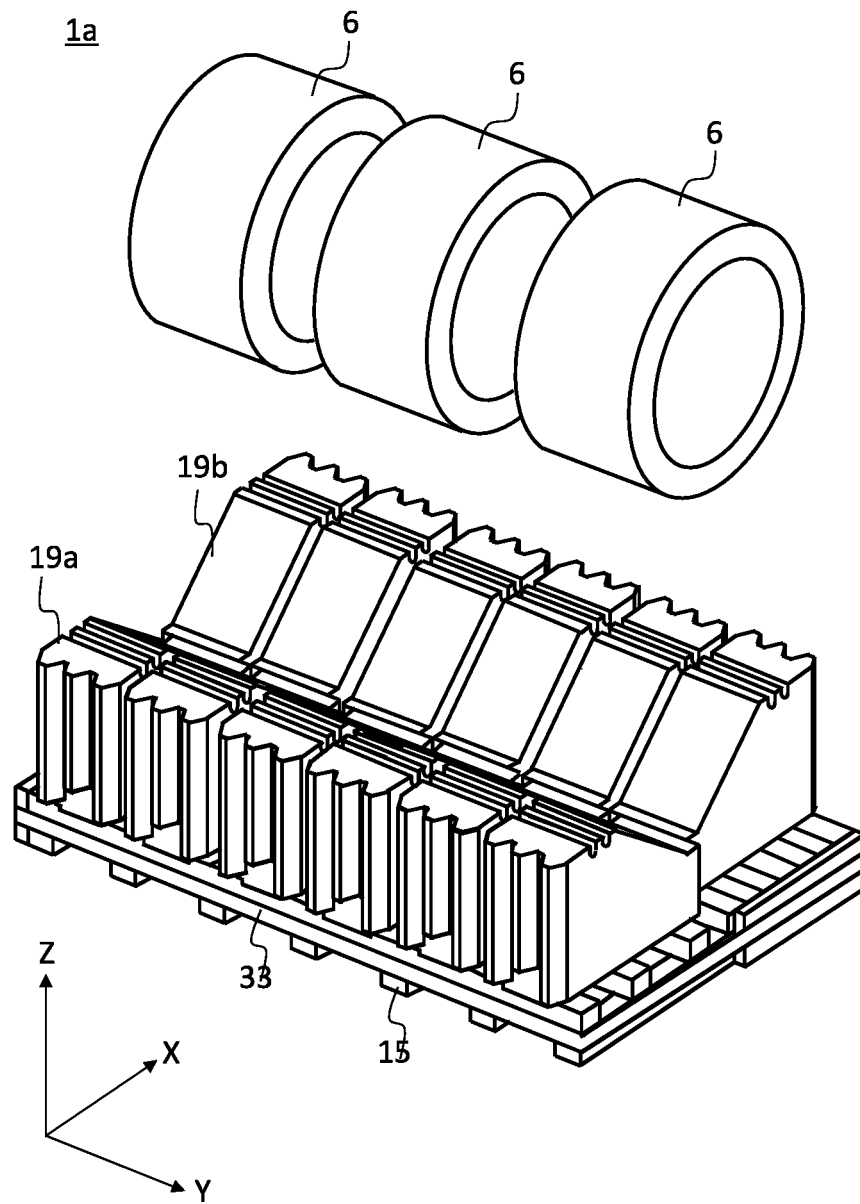


FIG.19

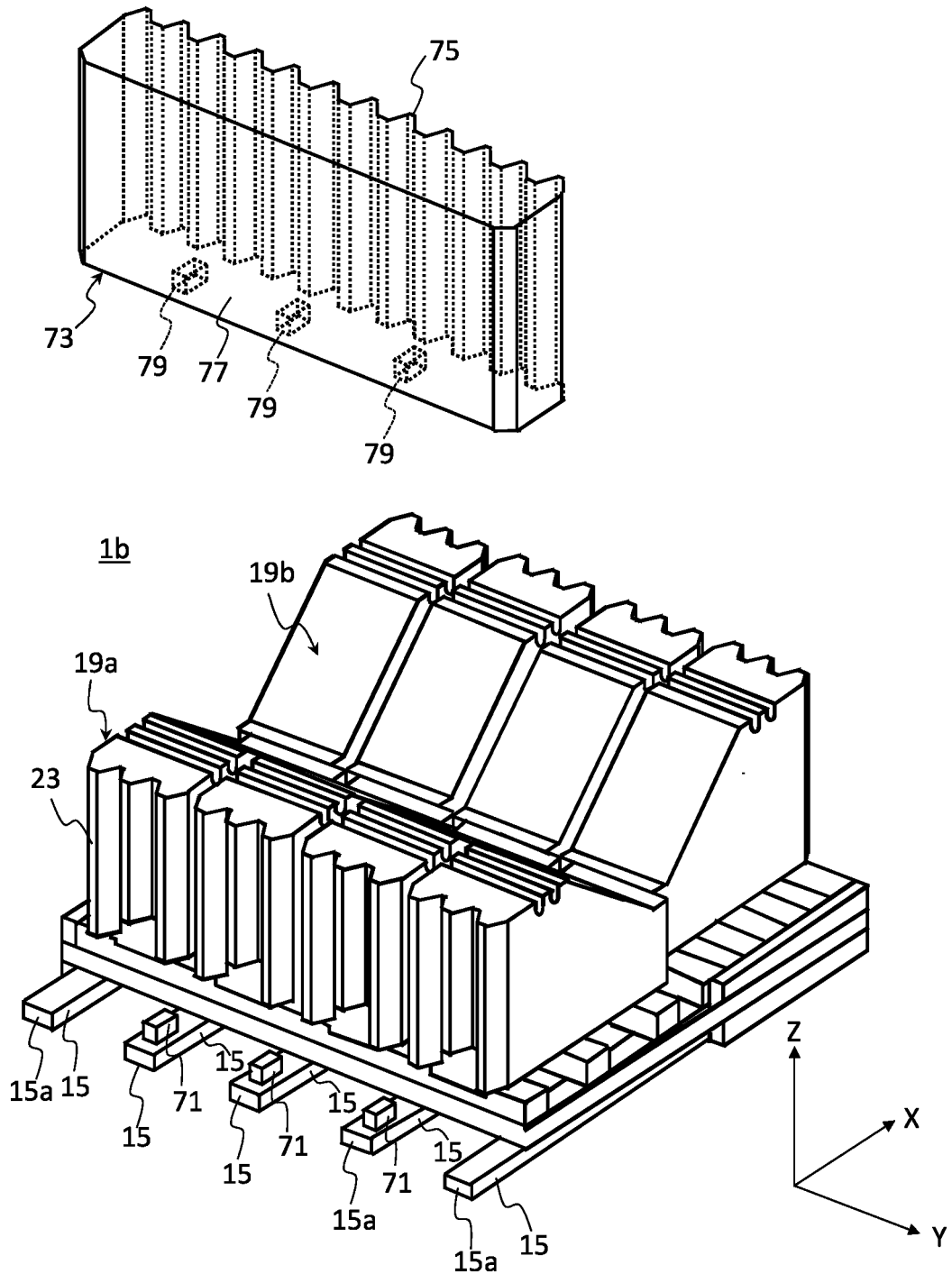


FIG.20

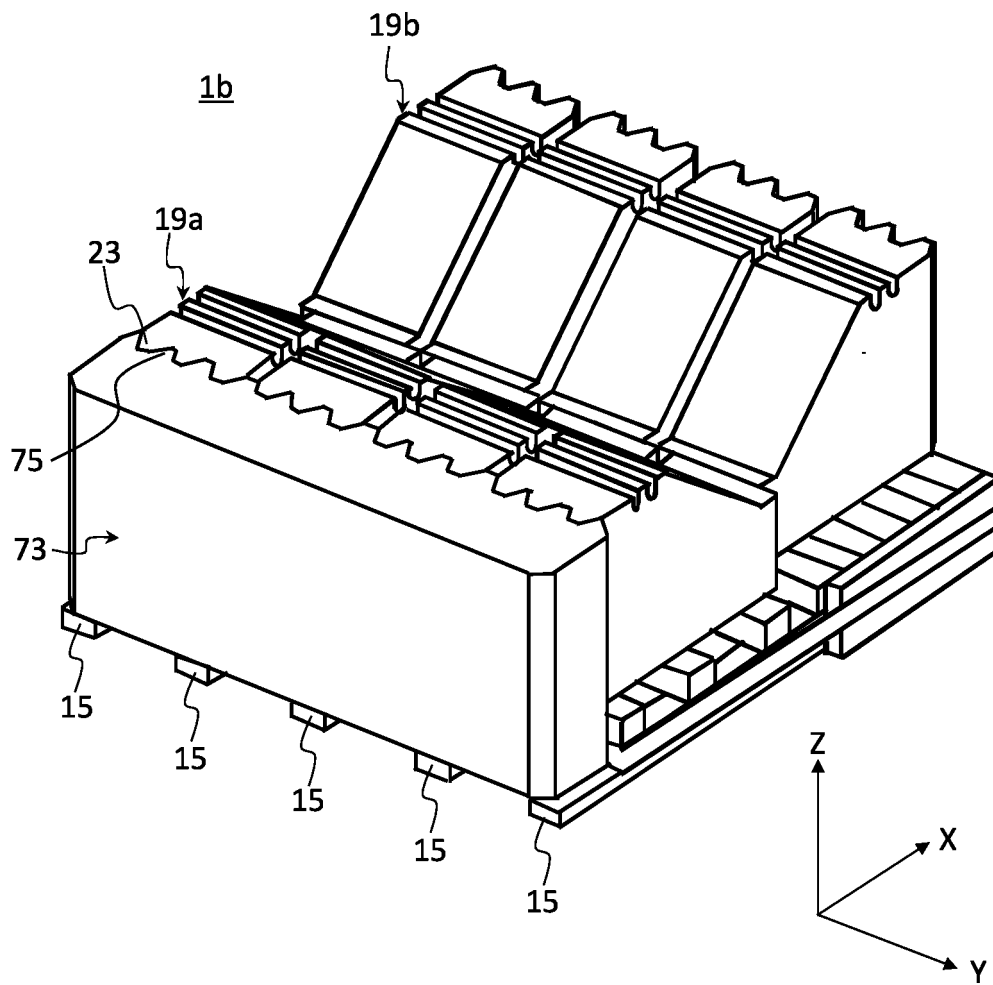


FIG.21

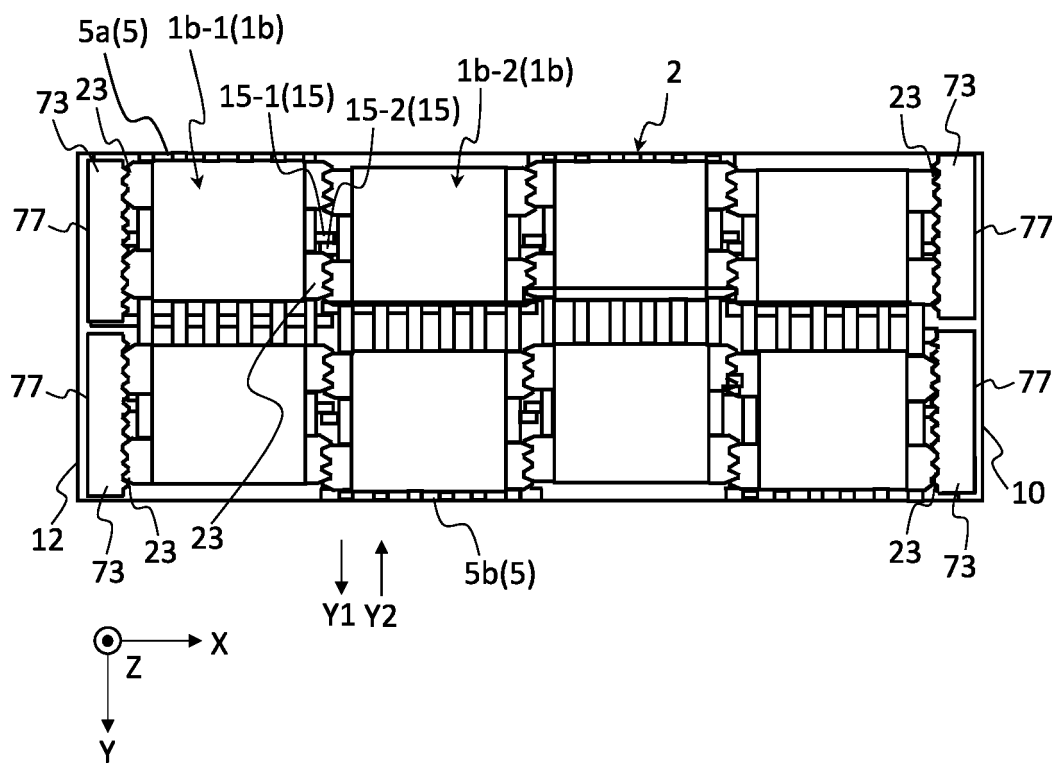


FIG.22

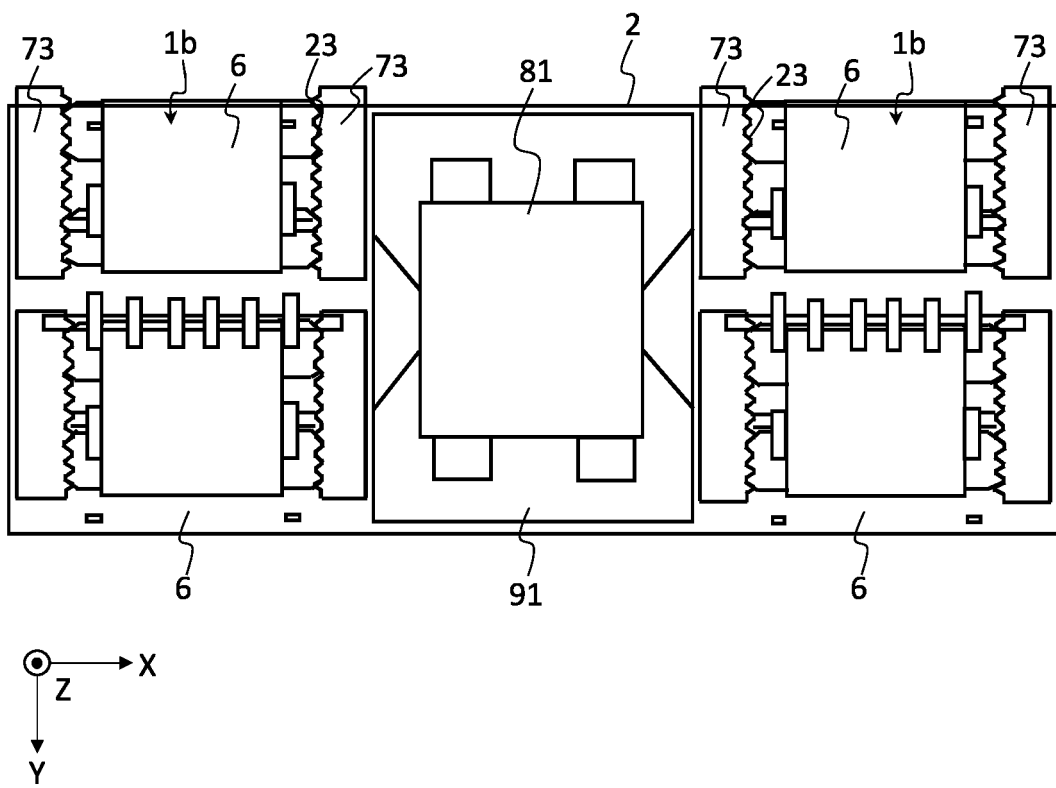
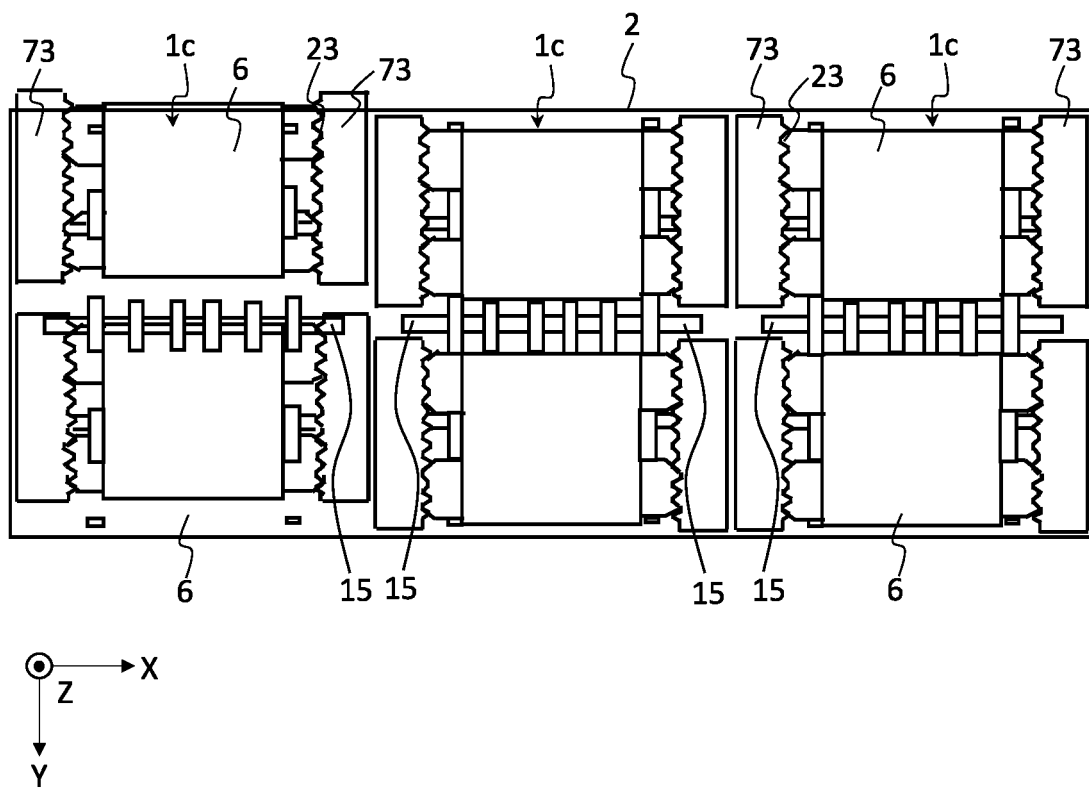


FIG.23



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2021/025758

A. CLASSIFICATION OF SUBJECT MATTER

B65D 19/24(2006.01)i; B65D 19/44(2006.01)i; B65D 85/66(2006.01)i
 FI: B65D85/66; B65D19/44; B65D19/24 A

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65D19/24; B65D19/44; B65D85/66; B65D88/12; B65D90/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2021

Registered utility model specifications of Japan 1996-2021

Published registered utility model applications of Japan 1994-2021

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2019-99192 A (MOL TECHNO-TRADE, LTD.) 24 June 2019 (2019-06-24)	1-18
A	JP 2020-125137 A (MITSUI O.S.K. LINES, LTD.) 20 August 2020 (2020-08-20)	1-18
A	US 2849151 A (AMERICAN VISCOSE CORPORATION) 26 August 1958 (1958-08-26)	1-18
A	JP 2005-514279 A (A-FAX LIMITED) 19 May 2005 (2005-05-19)	1-18
A	JP 2018-126771 A (KANEKA CORP.) 16 August 2018 (2018-08-16)	1-18

☒	Further documents are listed in the continuation of Box C.	☒	See patent family annex.
*	Special categories of cited documents:	"I"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 30 August 2021 (30.08.2021)	Date of mailing of the international search report 21 September 2021 (21.09.2021)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

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INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2021/025758
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2001-170709 A (KAWASAKI STEEL CORP.) 26 June 2001 (2001-06-26)	1-18

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/JP2021/025758

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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JP 2020-125137 A	20 Aug. 2020	(Family: none)	
US 2849151 A	26 Aug. 1958	(Family: none)	
JP 2005-514279 A	19 May 2005	US 2005/0121658 A1	
		WO 03/057575 A2	
		CA 2477394 A1	
JP 2018-126771 A	16 Aug. 2018	(Family: none)	
JP 2001-170709 A	26 Jun. 2001	(Family: none)	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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