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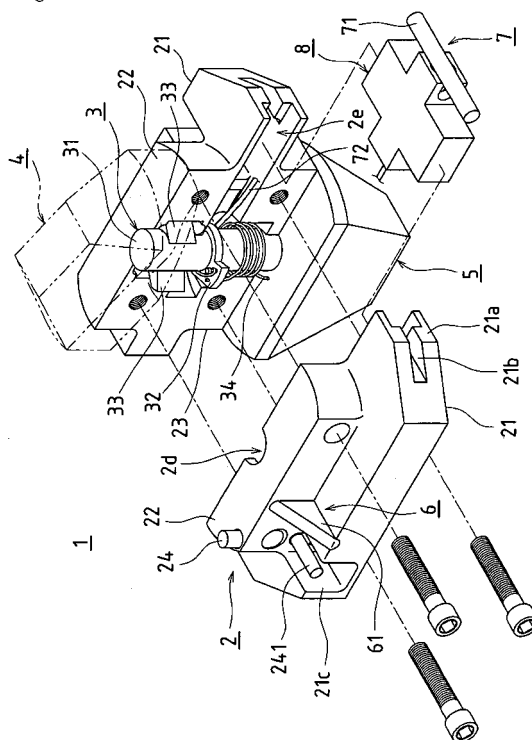
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(54) **CONTAINER CONNECTING METAL FIXTURE**

(57) A container coupling metal joint of the invention comprises a joint main body 2 having an upper fitting portion 22 and a lower fitting portion 23 capable of respectively fitting into engaging apertures of container corner fittings of the container, a shaft 3 pivoted rotatably to the joint main body 2, an upper metal fitting 4 and a lower metal fitting 5 capable of respectively engaging with the engaging apertures of the corner fittings of the container, and an operation member 7 for rotating the shaft. The joint main body 2 is provided with a rotation mechanism 6 for rotating the shaft 3 by receiving the action of the load of the container. The shaft 3 is provided with spring means 34 for urging and rotating the upper metal fitting 4 to the position at which it overlaps the upper fitting portion 22. The upper metal fitting 4 includes cutouts 4x formed at diagonally opposite corner portions of the lower face on the side in engagement with the engaging apertures of the corner fittings of the container.

Fig.2



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Description

TECHNICAL FIELD

[0001] The present invention relates to a container coupling metal joint for coupling two containers together, disposed between vertically adjacent containers stacked in multi-layers in a container yard or on a container ship.

BACKGROUND ART

[0002] Generally, as shown in Fig. 22, containers Ct are loaded and unloaded from a container yard Yd to a container ship Sh and vice versa.

[0003] When, for example, containers Ct in the container yard Yd are loaded onto the container ship Sh, the containers Ct are transferred from the container yard Yd onto a container conveying vehicle V such as a trailer, using a transfer crane Tc or a straddle carrier and, then, the containers Ct are conveyed to an apron Ap. Next, on the apron Ap, the containers Ct are lifted up by a spreader Sp of a container crane Cr and are placed on other containers Ct on the deck of the container ship Sh.

[0004] On the other hand, when containers Ct on the deck of the container ship Sh are unloaded, the containers Ct are lifted up using the spreader Sp of the container crane Cr and are moved to the apron Ap. Then, the containers are transferred to the container conveying vehicle V and are conveyed from the apron Ap to the container yard Yd.

[0005] In this way, when the containers Ct are stacked in layers in the container yard Yd and on the container ship Sh, in order to prevent the containers Ct from coming unfastened and shifted, container coupling metal joints are disposed respectively between each of the corner fittings provided on the lower four (4) corners of each container Ct of an upper layer and each of the corner fittings provided on the upper four (4) corners of each container Ct of a lower layer and are coupled to each other between counterparts.

[0006] Such a container coupling metal joint is described in, for example, International Publication WO92/05093.

[0007] First, this container coupling metal joint generally designated at 100 will be described with reference to Figs. 23 to 26.

[0008] The container coupling metal joint 100 comprises a joint main body 101 dividable to right and left which are fastened together by a bolt as one part, a shaft 102 (see Fig. 26) pivoted rotatably to the joint main body 101 and, an upper cone 103 and a lower cone 104 connected integrally to the upper end and the lower end, respectively, of the shaft 102.

[0009] The joint main body 101 is provided with an upper fitting portion 101U and a lower fitting portion 101D formed integrally at the top and the bottom thereof, respectively, and each having a shape that coincides with an engaging aperture Fa (see Fig. 29) of a corner fitting

F of a container Ct. The upper fitting portion 101U and the lower fitting portion 101D can fit respectively in the engaging aperture Fa of the lower corner fitting F of an upper container Ct and the engaging aperture Fa of the upper corner fitting F of a lower container Ct.

[0010] The joint main body 101 includes a through hole (not shown) that extends through the upper fitting portion 101U and the lower fitting portion 101D to pivotally receive the shaft 102.

[0011] The corner fitting F of the container Ct will not be illustrated in detail herein, but it is defined in JIS Z1616 as well as the engaging aperture Fa.

[0012] On the other hand, the upper cone 103 and the lower cone 104 are capable of engaging with the engaging apertures Fa of the corner fittings F of the container Ct and are each formed into a shape corresponding to the engaging apertures Fa of the corner fittings F. Furthermore, the upper cone 103 and the lower cone 104 rotate respectively on the upper face of the upper fitting portion 101U and on the lower face of the lower fitting portion 101D of the joint main body 101 as the shaft 102 rotates. These upper cone 103 and lower cone 104 are connected integrally to the shaft 102, crossing in X when viewed from above such that the lower cone 104 comes into engagement with the engaging aperture Fa of the upper corner fitting F of the lower container Ct when the upper cone 103 can be freely inserted in and released from the engaging aperture Fa of the lower corner fitting F of the upper container Ct, and that the upper cone 103 comes into engagement with the engaging aperture Fa of the lower corner fitting F of the upper container Ct when the lower cone 104 can freely be inserted in and removed from the engaging aperture Fa of the upper corner fitting F of the lower container Ct.

[0013] The lower cone 104 is formed in such a shape that, while the lower cone 104 is placed at a position where it engages with the engaging aperture Fa of one corner fitting F, a rotation force is applied thereto at the moment when it is pressed into the engaging aperture Fa of the corner fitting F. That is, the lower cone 104 is shaped such that, under the situation where the shaft 102 is at a first rotational position A described later with the lower cone 104 being in engagement with the engaging aperture Fa of the corner fitting F, when the lower cone 104 is brought into contact with and pressed against the edge of the engaging aperture Fa of the corner fitting F, the pressing force is applied to the corner fitting F through the lower cone 104 whilst the lower cone 104 receives a reaction force thereof, with the result that the lower cone 104 is rotated around the rotation axis of the shaft 102 by the reaction force acting on the lower cone 104.

[0014] On the other hand, as shown in Fig. 26, within the interior of the joint main body 101 is formed a cavity 101X having a first locking portion 101a and a second locking portion 101b against which an arm 1021 secured integrally to the shaft 102 can be abutted. For this reason, the shaft 102 can rotate from the first rotational position

A at which the arm 1021 abuts against the first locking portion 101a of the cavity 101X, to a third rotational position C at which the arm 1021 abuts against the second locking portion 101b.

[0015] The shaft 102 is disposed with a torsion spring 105 which ordinarily urges the shaft 102 so that the arm 1021 abuts against the first locking portion 101a of the cavity 101X. Furthermore, a wire 106 is wound around the shaft 102 along a groove 1022 formed around the shaft 102, with a loop portion at one end of the wire 106 being inserted through the arm 1021, the other end being led outside a mouthpiece 107 through the mouthpiece 107 disposed slidably on the joint main body 101 and being anchored to an operation knob 108. A locking member 1061 is formed in the vicinity of the other end of the wire 106. The locking member 1061 can selectively lock into slots 107a and 107c formed in the upper part and the lower part of the mouthpiece 107 that is fitted slidably via its right and left ends into a guide 101Y of the joint main body 101.

[0016] Via its right and left ends the mouthpiece 107 is fitted in the guide 101Y of the joint main body 101 and is disposed slidably along the guide 101Y such that it is urged ordinarily so as to come into abutment against one end of the guide 101Y by a spring 109 disposed on the joint main body 101.

[0017] In order to couple the upper and lower containers Ct with the container coupling metal joint 100 having such a structure, first, the containers Ct are transferred from the container yard Yd onto the container conveying vehicle V using the transfer crane Tc and are conveyed to the apron Ap. Then, on the apron Ap, the containers Ct are lifted up to a level of about one (1) meter above the ground by the spreader Sp of the container crane Cr and are stopped thereat. Then, the upper cone 103 of the container coupling metal joint 100 is attached to the lower corner fittings F of the containers Ct (see Fig. 27). More specifically, the operation knob 108 is grasped and drawn to lock the locking member 1061 of the wire 106 into the slot 107a of the mouthpiece 107. Under this status, the shaft 102 is at the third rotational position C at which the arm 1021 abuts against the second locking portion 101b of the cavity 101X of the joint main body 101, with the upper cone 103 being positioned such that it overlaps the upper fitting portion 101U of the joint main body 101 when viewed from above. This allows the upper cone 103, together with the upper fitting portion 101U of the joint main body 101, to be inserted into the engaging aperture Fa of the lower corner fitting F of the upper container Ct.

[0018] After inserting the upper cone 103 into the engaging aperture Fa, the operation knob 108 is again grasped and drawn to release the locking member 1061 of the wire 106 from the slot 107a of the mouthpiece 107. As a result, the shaft 102 returns by a biasing force of the torsion spring 105 to the first rotational position A at which the arm 1021 of the shaft 102 abuts against the first locking portion 101a of the cavity 101X of the joint

main body 101. Under this status, since the upper cone 103 and the lower cone 104 of the container coupling metal joint 100 are engaged respectively with the engaging apertures Fa of the corner fittings F as described above, the container coupling metal joint 100 can not fall off the corner fittings F of the container Ct (see Fig. 28).

[0019] After attaching the container coupling metal joints 100 to the lower corner fittings F of the container Ct, the container Ct is lifted up by the container crane Cr and placed on another container Ct on the deck of the container ship Sh (see Fig. 29). In this case, the lower cone 104 of the container coupling metal joint 100 is rotated forcibly along the rim of the engaging aperture Fa of the upper corner fitting F of the container Ct, against the biasing force of the torsion spring 105 and, when the lower cone 104 overlaps the lower fitting portion 101D of the joint main body 101 when viewed from above, the lower cone 104 as well as the lower fitting portion 101D of the joint main body 101 are fitted into the engaging aperture Fa of the upper corner fitting F of the container Ct. Then, once the lower cone 104 fits into the upper corner fitting F, the lower cone 104 returns again to the engagement position by virtue of the biasing force of the torsion spring 105 and is brought into engagement with the engaging aperture Fa of the corner fitting F. Consequently, the upper and the lower containers Ct are coupled together by the upper cones 103 and the lower cones 104 of the container coupling metal joint 100 engaged respectively with the lower corner fittings F of the upper container Ct and with the upper corner fittings F of the lower container Ct (see Fig. 30).

[0020] On the other hand, when the containers Ct on the deck of the container ship Sh are unloaded, the lower cone 104 at its engagement position is pulled down or pressed down using the operation knob, causing the locking member 1061 of the wire 1061 to lock into the slot 107c of the mouthpiece 107. Under this status, the shaft 102 can be disengaged from the engaging aperture Fa of the upper corner fitting F of the lower container Ct since the arm 1021 is at a second rotational position B between the first locking portion 101a and the second locking portion 101b of the cavity 101X of the joint main body 101 so that the lower cone 104 overlaps the lower fitting portion 101D of the joint main body 101 when viewed from above (see Fig. 31).

[0021] Next, after the containers Ct are lifted up and moved by the spreader Sp of the container crane Cr and stopped at a level of about one (1) meter above the ground, the upper cones 103 of the container coupling metal joints 100 are released from the lower corner fittings F of the containers Ct. That is, by grasping and drawing the operation knob 108, the locking member 1061 of the wire 106 is locked into the slot 107a of the mouthpiece 107. Under this status, as described above, the shaft 102 is at the third rotational position C at which the arm 1021 abuts against the second locking portion 101b of the cavity 101X of the joint main body 101 so that the upper cone 103 overlaps the upper fitting portion

101U of the joint main body 101 when viewed from above. For this reason, it is possible to disengage the container coupling metal joint 100 from the engaging aperture Fa of the lower corner fitting F of the upper container Ct (see Fig. 32). After this, the containers Ct are transferred from the container crane Cr onto the container conveying vehicle V by which the containers Ct are conveyed from the apron Ap to the container yard Yd.

DISCLOSURE OF THE INVENTION

[0022] In case of the conventional container coupling metal joint described hereinabove, when the container is loaded, the container coupling metal joint is attached to the lower corner fitting of the container to be loaded and, once it is placed on another container, the lower cone thereof rotates along the rim of the engaging aperture of the upper corner fitting of the lower container and it is fitted in the corner fitting, as a result of which the lower cone is automatically returned to the position at which it engages with the corner fitting by the torsion spring so as to allow the upper and lower containers to be coupled together. However, when containers are unloaded, it is necessary to operate the operation knob to cause the shaft, i. e. the lower cone to rotate from the position at which it is engaged with the corner fitting against the biasing force of the torsion spring to the position at which it can be freely inserted or released. That is, as shown in Fig. 31, it is necessary for a worker to pull down or press down the operation knob from the uppermost container of containers stacked in multi-layers or from the deck (in case of a container ship) or on the ground (in case of a container yard) using an elongated tool, causing the locking member of the wire to be locked into the slot of the mouthpiece. In this case, there are problems that it is difficult to operate securely the operation knob with the tip of the elongated tool, that much time is necessary to carry out this work and that the fatigue caused by operating the heavy elongated tool is considerable. Furthermore, in the case where the operation starts from the uppermost container, this work has a disadvantage from the viewpoint of safety since the work is carried out at an elevated place and it accompanies danger such as falling down.

[0023] The inventors applied before a container coupling metal joint described in Re-Publication Patent Application WO00/23358 but this joint has a disadvantage that its costs are high and its operation becomes uncertain when it is used over a long period of time due to its complicated structure.

[0024] The present invention was conceived in view of the above problems and the object thereof is to provide a container coupling metal joint with a simplified structure, capable of coupling automatically the container to be loaded with the underlying container as well as releasing automatically the coupled containers without any work at an elevated place.

[0025] In order to attain the above object, a container

coupling metal joint of the present invention comprises a joint main body having an upper fitting portion and a lower fitting portion capable of fitting into engaging apertures of corner fittings of containers; a shaft pivoted rotatably to the joint main body; an upper metal fitting and a lower metal fitting connected integrally respectively to the upper end and the lower end of the shaft and capable of engaging with the engaging apertures of the corner fittings of the containers; and an operation member for rotating the shaft, the joint main body being provided with a rotation mechanism for rotating the shaft by receiving the action of load of the container, the shaft being provided with a spring means for urging the upper metal fitting such that the upper metal fitting rotates to the position at which it overlaps the upper fitting portion, the upper metal fitting having cutouts diagonally oppositely formed at corner portions of its lower face on the side in engagement with the engaging apertures of the corner fittings of the containers, wherein when, through the operation member, the upper metal fitting is at the position at which it comes into engagement with the engaging aperture of the corner fitting of the container, against the biasing force of the spring means, the lower metal fitting is at the position at which it overlaps the lower fitting portion, wherein when the corner fitting of the container presses the rotation mechanism, the shaft is rotated against the biasing force of the spring means, causing the lower metal fitting to rotate to the position at which it comes into engagement with the engaging aperture of the corner fitting of the container, and wherein when the corner fitting of the container is raised along the cutout of the upper metal fitting and is released from the rotation mechanism, the shaft is rotated by the biasing force of the spring means, causing the lower metal fitting to rotate to the position at which it overlaps the lower fitting portion.

[0026] According to this constitution, when the container is loaded, first, the upper metal fitting is rotated to the position at which it overlaps the upper fitting portion and the upper metal fitting is inserted in the lower corner fitting through the engaging aperture of the lower corner fitting of the container. Inserting of the upper metal fitting into the engaging aperture of the lower corner fitting allows the operation member to be drawn against the biasing force of the spring means, causing rotation of the upper metal fitting to the position at which it is engaged with the engaging aperture of the lower corner fitting of the container. At this moment, the paired cutouts located at diagonally opposite positions of the upper metal fitting strike against the lower corner fitting so that the container coupling metal joint is attached to the lower corner fitting. The lower corner fitting lies at the position at which it overlaps the lower fitting portion. Under this status, once the lifted container is placed on the underlying container, the lower metal fitting can be inserted into the upper corner fitting through the engaging aperture of the upper corner fitting of the container.

[0027] In this case, since descending of the lifted container leads to abutment of the lower corner fitting of the

container against the rotation mechanism to allow the mechanism to bear the weight, the shaft is rotated against the biasing force of the spring means. For this reason, it is possible to rotate the lower metal fitting from the position at which it overlaps the lower fitting portion to the position at which it is engaged with the engaging aperture of the upper corner fitting as well as to rotate the upper metal fitting to the position at which it is further engaged with the engaging aperture of the lower corner fitting, thus enabling the upper container and the lower container to be coupled together.

[0028] On the other hand, when the container is unloaded, lifting up of the container results, first, in the container ascending by the height corresponding to that of the cutouts formed in the upper metal fitting. In consequence, the lower corner fitting of the container is detached from the rotation mechanism so that the shaft is rotated with the biasing force of the spring means. That is, the lower metal fitting can be detached from the upper corner fitting through the engaging aperture of the upper corner fitting of the container since the lower metal fitting is rotated from the position at which it is engaged with the engaging aperture of the lower corner fitting to the position at which it overlaps the lower fitting portion.

[0029] In this way, by causing the upper metal fitting to engage with the engaging aperture of the lower corner fitting of the container, transferring the container with the container coupling metal joint attached thereto and placing it on the underlying container, the lower metal fitting is inserted through the engaging aperture of the upper corner fitting of the underlying container and, then, the lower metal fitting comes into engagement with the engaging aperture. On the contrary, since the engaged status of the lower engaging with the engaging aperture of the upper corner fitting of the lower container can be released when the container is lifted up, it is possible to couple automatically the upper and the lower containers by the container coupling metal joint when the containers are loaded. It is also possible to release automatically the container coupling metal joint from the lower container when the containers are unloaded. Consequently, the amount of work can be reduced since workers do not need to operate the tools from, e. g. , positions on containers and safety can be secured since the work at an elevated place is unnecessary.

[0030] In the above constitution, the rotation mechanism may be a pressing piece in the shape of substantially a right triangle fitted in slidably along a guide aperture and a guide groove formed on the joint main body, and the shaft may be rotated by sliding of the pressing piece pressed by the corner fitting of the container.

[0031] According to this constitution, when the container is lowered, once the lower corner fitting of the container abuts against the slope of the pressing piece and causes the load of the container to act thereon, the pressing piece slides along the guide aperture and the guide groove, and abuts against and thrusts out the shaft. For this reason, the shaft is rotated against the biasing force of the

spring means, and the upper metal fitting and the lower metal fitting are respectively rotated to the positions at which they are respectively engaged with the engaging apertures of the corner fittings of the containers.

5 **[0032]** The rotation mechanism may include an ascending/descending member capable of freely ascending and descending and an articulated link mechanism abutted by the ascending/descending member and urged always in such a direction that it is articulated, and
10 the shaft may be rotated by stretching of the articulated link mechanism through the ascending/descending member pressed by the corner fitting of the container.

[0033] According to this constitution, when the container is lowered, once the lower corner fitting of the container
15 abuts against the ascending/descending member and causes the load of the container to act thereon, the articulated link mechanism is stretched through the ascending/descending member that is descending, abuts against the shaft and thrusts out the shaft. For this reason,
20 the shaft is rotated against the biasing force of the spring means, and the upper metal fitting and the lower metal fitting are respectively rotated to the positions at which they are respectively engaged with the engaging apertures of the corner fittings of the containers.

25 **[0034]** The rotation mechanism may be a sliding member slidable along a guide path formed on the joint main body, and the shaft may be rotated by sliding along the guide path of the sliding member pressed by the corner fitting of the container.

30 **[0035]** According to this constitution, when the container is lowered, once the lower corner fitting of the container abuts against the sliding member and causes the load of the container to act thereon, the sliding member slides along the guide path, and abuts against and thrusts out
35 the shaft. For this reason, the shaft is rotated against the biasing force of the spring means, and the upper metal fitting and the lower metal fitting are respectively rotated to the positions at which they are respectively engaged with the engaging apertures of the corner fittings of the
40 containers.

[0036] The rotation mechanism may include an ascending/descending member capable of freely ascending and descending along the outer peripheral surface of the shaft and having an inwardly protruding pin, a spiral
45 groove formed on the shaft and into which is fitted the pin of the ascending/descending member, and a spring urging the ascending/descending member to its raised position, and the shaft may be rotated by descending of the ascending/descending member pressed by the corner fitting of the container.

50 **[0037]** According to this constitution, when the container is lowered, once the lower corner fitting of the container abuts against the ascending/descending member and causes the load of the container to act thereon, the ascending/descending member provided with a pin is lowered. At this moment, the pin thrusts downward the spiral
55 groove since the pin is fitted in the spiral groove formed on the shaft. For this reason, the shaft is rotated against

the biasing force of the spring means, and the upper metal fitting and the lower metal fitting are respectively rotated to the positions at which they are respectively engaged with the engaging apertures of the corner fittings of the containers.

[0038] The rotation mechanism may include an ascending/descending member capable of freely ascending and descending along the outer peripheral surface of the shaft and having a spiral groove formed on its inner peripheral surface, a pin disposed on the shaft and fitted into the spiral groove of the ascending/descending member, and a spring urging the ascending/descending member to its upper position, and the shaft may be rotated by descending of the ascending/descending member pressed by the corner fitting of the container.

[0039] According to this constitution, when the container is lowered, once the lower corner fitting of the container abuts against the ascending/descending member and causes the load of the container to act thereon, the ascending/descending member formed with a spiral groove descends. At this moment, the pin moves along the descending spiral groove since the pin provided on the shaft is fitted in the spiral groove. For this reason, the shaft is rotated against the biasing force of the spring means, and the upper metal fitting and the lower metal fitting are respectively rotated to the positions at which they are respectively engaged with the engaging apertures of the corner fittings of the containers.

[0040] In the above constitution, it is preferred that the operation member include an operation lever and a connector with its one end connected to the operation lever and with the other end connected to the shaft, and that the joint main body be formed with a locking portion capable of locking the operation lever and a housing portion capable of housing the operation lever.

[0041] According to this constitution, by grasping the operation lever as well as drawing it against the biasing force of the spring means to allow locking into the locking portion of the joint main body, it is possible to rotate the shaft by means of the coupling tool, to rotate the upper metal fitting and the lower metal fitting secured to the shaft respectively to the positions at which they are respectively engaged with the engaging apertures of the corner fittings of the containers and to keep them at those positions.

[0042] In the above constitution, the upper fitting portion of the joint main body is preferably provided at its one corner portion a stopper urged in such a direction that it protrudes from the upper face thereof and capable of freely protruding and retreating, the upper metal fitting being abutted against the stopper so that the upper metal fitting is held at a position at which it is engaged with the engaging aperture of the corner fitting of the container.

[0043] According to this constitution, the stopper is usually kept protruded from the upper face of the upper fitting portion by the biasing force of the spring and the upper metal fitting abuts against the stopper and is at the position at which the upper metal fitting is engaged with

the engaging aperture of the corner fitting of the container. For this reason, by retreating the stopper inside the joint main body, the upper metal fitting is rotated by the biasing force of the spring means to the position at which it overlaps the upper fitting portion and the upper metal fitting can be inserted into the lower corner fitting through the engaging aperture of the lower corner fitting of the container. Under this status, once the upper metal fitting is rotated to the position at which it is engaged with the engaging aperture of the lower corner fitting by drawing the operation member against the biasing force of the spring means, the stopper is protruded from the upper face of the upper fitting portion by the biasing force of the spring and, thereafter, the upper metal fitting abuts against the stopper, is prevented from rotating to the position at which it overlaps the upper fitting portion and stays at the position at which it engages with the engaging aperture of the lower corner fitting of the container. For this reason, when the container is transferred with the container coupling metal joints attached to the lower corner fittings of the container, the container coupling metal joints can be prevented surely from falling off from the lower corner fittings.

[0044] In the above constitution, the joint main body is preferably provided with a safety mechanism for preventing the rotation of the shaft by the biasing force of the spring means when the container coupling metal joint is tilted by a predetermined angle relative to the horizontal plane.

[0045] According to this constitution, since the corner fitting of the container is released from the rotation mechanism when the container tilts or jumps by a shake under the status where the upper and the lower containers are coupled with each other, the shaft, i.e., the lower metal fitting is attempted to be rotated to the position at which it overlaps the lower fitting portion. However, the shaft does not rotate since the rotation thereof is prevented by the safety mechanism. For this reason, the coupling status of the upper and the lower containers can be maintained securely.

[0046] In the above constitution, arrangement may be such that the safety mechanism includes a receptacle main body formed in the joint main body, a lid body covering the upper opening of the receptacle main body, a moving element provided capable of freely moving back and forth with respect to the receptacle main body, the moving element being penetrated by the connector and abutted by the operation lever, and a rolling element capable of freely rolling and arranged on an outward declined slope formed on the receptacle main body, and that when the safety mechanism is tilted by an angle exceeding a predetermined angle, movement of the moving element is prevented by the rolling element.

[0047] According to this constitution, when the upper and lower containers tilt under the status where they are coupled with each other, the joint main body, i.e., the safety mechanism provided on the joint main body is also tilted, the rolling elements roll along one of the tilted faces

corresponding to the direction of the tilt and the backward move of the rolling elements is prevented. In this case, the operation lever does not move backward as far as the rolling elements do not move since the operation lever abuts against the rolling elements. Therefore, the coupler coupled to the operation lever maintains the status as it is and the rotation of the shaft caused by the biasing force of the spring means can be securely prevented.

[0048] The safety mechanism may include an inclined path declining outward formed on the joint main body, a rolling element capable of freely rolling and arranged on the inclined path, and a fitted recess formed on the shaft, and when the shaft is at the position at which it is rotatable by the articulated mechanism stretched, the inclined path of the joint main body and the fitted recess of the shaft may communicate with each other and, under this status, in the case where the safety mechanism is tilted by an angle exceeding a predetermined angle, rotation of the shaft may be prevented by fitting of the rolling element into the fitted recess.

[0049] According to this constitution, when the containers tilt under the status where they are coupled with each other, the joint main body, i.e., the safety mechanism provided on the joint main body is also tilted, the rolling elements roll along one of the tilted paths corresponding to the direction of the tilt and the rolling elements are fitted in the fitted recesses formed on the shaft facing the rolling elements. For this reason, rotation of the shaft caused by the biasing force of the spring means can be securely prevented.

[0050] The safety mechanism may include an inclined path climbing outward formed on the shaft, a rolling element capable of freely rolling arranged on the inclined path, and a fitted recess formed on the joint main body, and when the shaft is at the position at which it is rotatable by the sliding member slid, the inclined path of the shaft and the fitted recess of the joint main body may communicate with each other and, under this status, in the case where the safety mechanism is tilted joint by an angle exceeding a predetermined angle, rotation of the shaft may be prevented by fitting of the rolling element into the fitted recess.

[0051] According to this constitution, when the containers tilt under the status where they are coupled with each other, the joint main body, i.e., the safety mechanism provided on the joint main body is also tilted, the rolling elements roll along one of the tilted paths corresponding to the direction of the tilt and the rolling elements are fitted in the fitted recesses formed on the joint main body facing the rolling elements. For this reason, rotation of the shaft caused by the biasing force of the spring means can be securely prevented.

[0052] The safety mechanism may include an inclined path declining outward formed on the joint main body, a rolling element capable of rolling and arranged on the inclined path, and a fitted recess formed on the ascending/descending member, and when the ascending/descending member is at its lowered position, the inclined

path of the joint main body and the fitted recess of the ascending/descending member may communicate with each other and, under this status, in the case where the safety mechanism is tilted by an angle exceeding a predetermined angle, ascending of the ascending/descending member may be prevented by fitting of the rolling element into the fitted recess.

[0053] According to this constitution, when the containers tilt under the status where they are coupled with each other, the joint main body, i.e., the safety mechanism provided on the joint main body is also tilted, the rolling elements roll along one of the tilted paths corresponding to the direction of the tilt and the rolling elements are fitted in the fitted recesses formed on the ascending/descending member facing the rolling elements. For this reason, ascending of the ascending/descending member is prevented. In this case, the shaft does not rotate as far as the ascending/descending member does not ascend since the pin is fitted in the spiral groove. Therefore, the rotation of the shaft caused by the biasing force of the spring means can be securely prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0054]

Fig. 1 is an entire perspective view of a first embodiment of a container coupling metal joint of the present invention;

Fig. 2 is an exploded perspective view of the container coupling metal joint shown in Fig. 1;

Fig. 3 is a perspective view showing a half of a joint metal body constituting the container coupling metal joint shown in Fig. 1;

Fig. 4 is a perspective view showing a shaft, and an upper metal fitting and a lower metal fitting attached integrally to the shaft, constituting the container coupling metal joint shown in Fig. 1;

Fig. 5 is a perspective view showing the backside of the upper metal fitting;

Fig. 6 is a cross-sectional view on a plane crossing an upper fitting portion of the joint main body of the container coupling metal joint shown in Fig. 1;

Fig. 7 is a perspective view illustrating a safety mechanism constituting the container coupling metal joint shown in Fig. 1 and the action thereof;

Fig. 8 is a front view illustrating a status where the container coupling metal joint coupling the upper and the lower containers is tilted at a specific angle relative to a horizontal plane and a cross-sectional view taken along line A-A;

Fig. 9 is a perspective view showing the backside of an example of variation of the upper metal fitting;

Fig. 10 is a perspective view illustrating the process of attaching the container coupling metal joint shown in Fig. 1 to a lower corner fitting of a container;

Fig. 11 is a partially-exploded perspective view illustrating the status where the container coupling metal

joint shown in Fig. 1 is attached to the lower corner fitting of the container;

Fig. 12 is a perspective view illustrating the process of attaching the container coupling metal joint shown in Fig. 1 attached to the lower corner fitting of the container, to an upper corner fitting of another container;

Fig. 13 is a partially-exploded perspective view illustrating the status where the upper metal fitting and the lower metal fitting of the container coupling metal joint shown in Fig. 1 are respectively engaged with the lower corner fitting and the upper corner fitting of respective containers and the upper and the lower containers are coupled;

Fig. 14 is a perspective view illustrating the process of unloading the upper container coupled to the lower container with the container coupling metal joint shown in Fig. 1, from the lower container;

Fig. 15 is a partially-omitted longitudinal cross-sectional view illustrating a second embodiment of the container coupling metal joint of the invention;

Fig. 16 is a transverse cross-sectional view of the container coupling metal joint shown in Fig. 15;

Fig. 17 illustrates a partially-omitted longitudinal cross-sectional view illustrating a third embodiment of the container coupling metal joint of the invention;

Fig. 18 is a transverse cross-sectional view of the container coupling metal joint shown in Fig. 17;

Fig. 19 is a transverse cross-sectional view showing the status where the upper metal fitting and the lower metal fitting of the container coupling metal joint shown in Fig. 17 are respectively at the position at which each of them respectively engages at the corner fitting of the container;

Fig. 20 is a partially-omitted longitudinal cross-sectional view illustrating a fourth embodiment of the container coupling metal joint of the invention;

Fig. 21 is a transverse cross-sectional view of the container coupling metal joint shown in Fig. 20;

Fig. 22 is a view illustrating a situation where containers are transferred between a container yard and an apron by a container conveying vehicle and containers are loaded or unloaded between the container conveying vehicle and a container ship by a container crane;

Fig. 23 is a perspective view of a conventional container coupling metal joint;

Fig. 24 is a plan view of the container coupling metal joint shown in Fig. 23;

Fig. 25 is a bottom plan view of the container coupling metal joint shown in Fig. 23;

Fig. 26 is a transverse cross-sectional view of the container coupling metal joint shown in Fig. 23;

Fig. 27 is a view illustrating the process of the work of attaching the container coupling metal joint shown in Fig. 23 to a container and loading the container on the container ship;

Fig. 28 is a view illustrating the process of the work

of attaching the container coupling metal joint shown in Fig. 23 to a container and loading the container on the container ship;

Fig. 29 is a view illustrating the process of the work of attaching the container coupling metal joint shown in Fig. 23 to a container and loading the container on the container ship;

Fig. 30 is a view illustrating the process of the work of attaching the container coupling metal joint shown in Fig. 23 to a container and loading the container on the container ship;

Fig. 31 is a view illustrating the process of the work of unloading from the container ship containers loaded being coupled to each other by the container coupling metal joint shown in Fig. 23; and

Fig. 32 is a view illustrating the process of the work of unloading from the container ship containers loaded being coupled to each other by the container coupling metal joint shown in Fig. 23.

BEST MODE FOR CARRYING OUT THE INVENTION

[0055] Embodiments of the invention will be described hereinbelow with reference to the drawings.

[0056] Figs. 1 and 2 show a first embodiment of a container coupling metal joint 1 of the invention.

[0057] This container coupling metal joint 1 comprises a joint main body 2 dividable to right and left and fastened together by a bolt as one part, a shaft 3 pivoted rotatably to the joint main body 2, an upper metal fitting 4 connected to the upper end of the shaft 3 as one part, a lower metal fitting 5 connected to the lower end of the shaft 3, a rotation mechanism 6 for rotating the shaft 3 when the load of the container Ct works on it, an operating member 7 for rotating the shaft 3, i.e., the upper metal fitting 4 and the lower metal fitting 5 and a safety mechanism 8 for limiting the rotation of the shaft 3.

[0058] The joint main body 2 comprises a main body portion 21 which is larger than the engaging aperture Fa of the corner fitting F of the container Ct, an upper fitting portion 22 and a lower fitting portion 23 respectively provided on the upper portion and the lower portion of the main body portion 21 and having a shape engaged with the engaging aperture Fa of the corner fitting F of the container Ct. These upper fitting portion 22 and the lower fitting portion 23 are adapted to be able to be respectively engaged with the engaging aperture Fa of the lower corner fitting F of an upper container Ct and the engaging aperture Fa of the upper corner fitting F of a lower container Ct. At the front end of the main body portion 21 of the joint main body 2, a locking portion 21a for locking an operation lever 71 of an operating member 7 is formed and a housing portion 21b capable of housing the operation lever 71 is formed.

[0059] On the joint main body 2, as shown in Fig. 3, substantially in the middle thereof in the vertical direction, a cylindrical first cavity 2a is formed and a cuboidal second cavity 2b is formed above the first cavity 2a sand-

wiching a barrier between it and the first cavity 2a. A cylindrical third cavity 2c having a diameter smaller than that of the first cavity 2a is formed below the first cavity 2a and communicably with the first cavity 2a. Furthermore, in the joint main body 2, a through hole 2d is formed with its center aligned on the centers of the first cavity 2a and the third cavity 2c, that penetrates from the upper face of the upper fitting portion 22 to the lower face of the lower fitting portion 23. In front of the main body portion 21 of the joint main body 2, a fourth cavity 2e having an x-letter shape when viewed from above is formed, of which one end communicates with the first cavity 2a and the other end opens at the front end of the main body portion 21 (the locking portion 21a).

[0060] As described later, a flange portion 32, arms 33 of the shaft 3 pivoted rotatably to the through hole 2d of the joint main body 2, and a torsion spring 34 disposed around the shaft 3 are respectively housed in the first cavity 2a, the second cavity 2b and the third cavity 2c and, furthermore, the safety mechanism 8 is housed in the fourth cavity 2e.

[0061] Furthermore, a stopper 24 is formed on the joint main body 2 at its one corner, which is capable of being protruded and retreated and is urged through a spring not shown such that it is protruded from the upper face of the upper fitting portion 22. The stopper 24 includes an operation rod 241 formed integrally therewith such that the stopper 24 can retreat inside the joint main body 2 so as not to protrude from the upper face of the upper fitting portion 22 by pressing down the operation rod 241 against the biasing force of the spring.

[0062] A recess 21c is formed on the main body portion 21 of the joint main body 2 such that the operation rod 241 can be pressed down for a predetermined distance.

[0063] As shown in Figs. 2 and 4, the shaft 3 comprises, formed integrally therewith, a shaft portion 31 having an outer diameter corresponding to the diameter of the through hole 2d of the joint main body 2, the flange portion 32 having a diameter larger than that of the shaft portion 31 substantially in the middle of the shaft portion 31 and a pair of arms 33 protruding outward at an interval of about 180 degrees on the outer peripheral surface of the shaft portion 31 above the flange portion 32. The flange portion 32 and the arms 33 are respectively positioned such that the flange portion 32 is housed in the first cavity 2a of the joint main body 2 and the arms 33 are housed in the second cavity 2b.

[0064] Furthermore, below the shaft portion 31 of the shaft 3, sparing means, for example, a torsion spring 34 is fitted and one end of this torsion spring 34 is anchored at the flange portion 32 of the shaft 3 and the other end of it is anchored at the joint main body 2. In Fig. 4, the shaft 3 is urged such that it rotates counterclockwise (in the direction shown by the arrow) by the force of the torsion spring 34.

[0065] On the other hand, one end of a connecting tool, for example, a control cable 72 such as of Kevlar, of operation member 7 is anchored at the flange portion 32 of

the shaft 3 and the other end of it is anchored at the operation lever 71 through the safety mechanism 8.

[0066] The upper metal fitting 4 is fixed integrally at the upper end of the flange portion 31 of the shaft 3 and is formed in a shape corresponding to the engaging aperture Fa of the lower corner fitting F of the container Ct when viewed from above. Therefore, when the upper metal fitting 4 is positioned such that it overlaps the upper fitting portion 22 of the joint main body 2, the upper metal fitting 4 can be inserted into the lower corner fitting F through the engaging aperture Fa and, when inserted, the upper fitting portion 22 is engaged with the engaging aperture Fa of the lower corner fitting. Yet furthermore, a cutout 4x is formed in the upper metal fitting 4 at the lower corner on a diagonal that intersects the right and left outer faces of the upper fitting portion 22 when the upper metal fitting 4 is positioned intersecting the upper fitting portion 22 at a specific angle, i.e., is positioned such that the upper metal fitting 4 can be engaged with the engaging aperture Fa of the lower corner fitting F of the container Ct. The cutout 4x of the upper metal fitting 4 has a size being set such that the lower corner fitting F can be elevated by the height corresponding to the substantial thickness of the cutout 4x when the upper metal fitting 4 is positioned such that it can be engaged with the engaging aperture Fa of the lower corner fitting F of the container Ct. The outer face of the upper metal fitting 4 is chamfered in a curved plane such that it can smoothly contact the inner face of the engaging aperture Fa of the lower corner fitting F.

[0067] The lower metal fitting 5 is fixed integrally at the lower end of the shaft portion 31 of the shaft 3 and is formed in a shape corresponding to that of the engaging aperture Fa of the upper corner fitting F of the container Ct when viewed from above. Therefore, when the lower metal fitting 5 is positioned such that the lower metal fitting 5 overlaps the lower fitting portion 23 of the joint main body 2, the lower metal fitting 5 can be inserted into the upper corner fitting F through the engaging aperture Fa and, when inserted, the lower fitting portion 23 is engaged with the engaging aperture Fa of the upper corner fitting F.

[0068] In this case, the upper metal fitting 4 and the lower metal fitting 5 are fixed to the shaft 3 crossing each other in an x-letter shape when viewed from above. When the upper metal fitting 4 is caused to abut against the stopper 24 by the biasing force of the torsion spring 34 and is positioned such that it can be engaged with the engaging aperture Fa of the lower corner fitting F of the container Ct, the lower metal fitting 5 is positioned at a position such that it overlaps the lower fitting portion 23 of the joint main body 5, i.e., at the position at which the lower metal fitting 5 can be inserted into and released from the engaging aperture Fa of the upper corner fitting F of the container Ct (see Fig. 1). On the other hand, when the upper metal fitting 4 is rotated clockwise against the biasing force of the torsion spring 34 from the position at which it abuts against the stopper 24 to the position at

which it is engaged with the engaging aperture Fa of the upper corner fitting F of the container Ct, the lower metal fitting 5 is also positioned where it can be engaged with the engaging aperture Fa of the upper corner fitting F of the container Ct.

[0069] When the upper metal fitting 4 is positioned such that it abuts against the stopper 24, as shown by the solid line in Fig. 1, the operation lever 71 is housed in the housing portion 21b under a status where there is some room to the end of the depth of the housing portion 21b. Therefore, when the upper metal fitting 4 is rotated counterclockwise by the biasing force of the torsion spring 34 to the position at which it overlaps the upper fitting portion 22 by causing stopper 24 to retreat inward the joint main body 2 by pressing down the operation rod 241, the operation lever 71 is drawn through the control cable 72 to the position at which the operation lever 71 abuts against the end of the depth of the housing portion 21b. On the other hand, when the operation lever 71 is grasped and drawn in the direction leaving the paper upward such that, as indicated by the dotted line in Fig. 1, it is rotated by 90 degrees and caused to intersect the fitting main body 2 and to lock the locking portion 21a, the counterclockwise rotation of the shaft 3 caused by the biasing force of the torsion spring 34 can be limited through the control cable 72 connected between the shaft 3 and the operation lever 71. In this case, the shaft 3, i.e., the upper metal fitting 4 and the lower metal fitting 5, rotated counterclockwise through the control cable 72 against the biasing force of the torsion spring 34 are positioned at a position where the upper metal fitting 4 and the lower metal fitting 5 can respectively be engaged with the engaging apertures Fa of the corner fittings F of respective containers Ct.

[0070] The rotation mechanism 6 is a pair of pressing pieces 61 in the shape of substantially a right angle isosceles triangle disposed slidably on the upper fitting portion 22 of the joint main body 2. Each pressing piece 61 is slidably fitted in each guide aperture 61a (see Fig. 6) having substantially an ellipsoidal cross-section, formed in communication with the second cavity 2b and extending vertically in its longitudinal direction from the left and right outer sides, at substantially the diagonally opposite positions of the upper fitting portion 22 on the side intersecting in X the upper metal fitting 4 when the upper metal fitting 4 is at a position at which it is engaged with the engaging aperture Fa of the lower corner fitting F. Guide grooves 61b having a semi-circular cross-section and communicating with the guide apertures 61a are formed on the upper face of the main body portion 21 and on the upper and lower faces of the second cavity 2b such that, when the pressing pieces 61 slide along the guide aperture 61a, the base and the top side of the pressing piece 61 are respectively guided by the guide groove 61b.

[0071] The pressing pieces 61 are fitted in the guide apertures 61a such that the slopes of the pressing pieces 61 are positioned facing outward. When the lower corner fitting F of the container Ct abuts against the slope of the

pressing piece 61, the pressing piece 61 is thrust into the second cavity 2b along the guide aperture 61a and the guide groove 61b by the weight of the container Ct.

[0072] Then, the tip of the pressing piece 61 is set such that it abuts against each arm 33 in the second cavity 2b and, for example, when the upper metal fitting 4 is caused to abut the stopper 24 by the biasing force of the torsion spring 34, the pressing piece 61 is struck against by the arm 33 of the shaft 3 and thrust out by it along the guide aperture 61a and the guide groove 61b as shown in Fig. 6.

[0073] The safety mechanism 8 can be fitted in the fourth cavity 2e of the joint main body 2 and, as shown in Fig. 7 (a), comprises a receptacle main body 81 formed in an approximate x-letter shape, a lid body 82 which is formed in an substantially vertically symmetric shape to the receptacle main body 81 and opens and closes the upper opening of the receptacle main body 81 (see Fig. 7 (d)), a moving element 83 in an X-letter shape, arranged on the receptacle main body 81 and movable forward and backward, a spring 84 disposed on the receptacle main body 81 and the moving element 83 and always thrusting forward the moving element 83, rolling elements, for example, a pair of balls 85 respectively capable of rolling on each of slopes 8x (see Fig. 8 (b)) formed on the bottom plane of the receptacle main body 81 and declining outward to right and left, guides 86 formed in the receptacle main body 81 and forming housing spaces for the balls 85 such that the guides do not interfere with the right and left end faces of the moving element 83. Each ball 85 can roll on the slope 8x in a space extending to right and left defined by the guide 86 provided on the receptacle main body 81, the moving element 83 and the receptacle main body 81.

[0074] A locking portion 8a and a housing portion 8b that are fitted in the locking portion 21a and the housing portion 21b of the joint main body 2 when the safety mechanism 8 is arranged in the fourth cavity 2e of the joint main body 2, are formed on the receptacle main body 81 and the lid body 82.

[0075] An inserting through hole (not shown) is formed in the direction from the front to the back in the moving element 83. The control cable 72 inserted through the inserting through hole of the moving element 83 is anchored to the operation lever 71 striking against the front end of the moving element 83.

[0076] When the receptacle main body 81 is placed horizontally, each ball 85 contacts the inner wall surface on the right and the left at the lowest end of the slope 8x. At this moment, once the control cable is drawn backward, the moving element 83 can move backward against the biasing force of the spring 84 through the operation lever 71 housed in the housing portion 8b, 21b in a status where there is room to the end of the depth of them. At this moment, the operation lever 71 is housed in the status where the operation lever 71 abuts against the end of the depth of the housing portion 8b (see Fig. 7 (b)).

[0077] On the other hand, when the receptacle main body 81 is tilted by a predetermined angle from the hor-

horizontal position, more specifically, when it is tilted by an angle exceeding the inclination of the slope 8x (being set to approximately five (5) degrees in this embodiment), either one ball 85 rolls on the slope 8x in the space extending to the right and left and defined by the guide 86, the moving element 83 and the receptacle main body 81. Since a ball 85 is present between the moving element 83 and the receptacle main body 81, even if the control cable 72 is drawn backward, move of the moving element 83 is prevented. Therefore, the operation lever 71 does not move from the position corresponding to the locking portion 8a (see Fig. 7 (c) and Fig. 8 (b)) and the rotation of the shaft 3 is prevented.

[0078] Instead of the cutouts 4x of the upper metal fitting 4 of the above-described embodiment, as shown in Fig. 9, cutouts formed by the horizontal plane positioned at the height substantially corresponding to the plate thickness of the corner fitting F and a vertical plane continuing on each of the right and left outer sides of the upper fitting portion 22 is also available.

[0079] A case where balls 85 are used as the rolling elements of the safety mechanism 8 has been described. However, the rolling elements may be rollers.

[0080] Next, the action of the container coupling metal joint 1 will be described.

[0081] First, at the initial status, as shown in Figs. 1 and 2, the upper metal fitting 4 is caused to abut against the stopper 24 by the biasing force of the torsion spring 34 and is at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F of the container Ct. At this moment, the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23 of the joint main body 2. As shown in Fig. 6, the pressing piece 61 is abutted by the arm 33 of the shaft 3 and is thrust outward along the guide aperture 61a and the guide groove 61b. Furthermore, the operation lever 71 is housed in the housing portion 21b of the joint main body 2 (the housing portion 8b of the safety mechanism 8) remaining some room to the end of the depth of the housing portion 21b.

[0082] In order to attach the container coupling metal joint 1 to the engaging aperture Fa of the corner fitting F of the container Ct, first, the stopper 24 is caused to retreat inside the joint main body 2 from the position at which the stopper 24 is protruded from the upper face of the upper fitting portion 22 by pressing down the operation rod 241 against the biasing force of the spring. At this moment, since the limitation on the rotation of the upper metal fitting 4 by the stopper 24 is released, the shaft 3 is rotated to the position at which the upper metal fitting 4 overlaps the upper fitting portion 22 by the biasing force of the torsion spring 34. During this, the operation lever 7 is drawn backward through the control cable 72 by the distance created by the rotation of the shaft 3, and is housed in the housing portion 21b of the joint main body 2 (the housing portion 8b of the safety mechanism 8) striking against the end of the depth of the housing portion 21b (see Fig. 7 (b)).

[0083] Under this status, the upper metal fitting 4 is inserted into the lower corner fitting F through the engaging aperture Fa of the lower corner fitting F of the container Ct lifted up at the height of about one (1) meter on the ground by the container crane Ct, by lifting up the container coupling metal joint 1 on the apronAp (see Fig. 10). Following this, once the operation lever 71 is drawn against the biasing force of the torsion spring 34, the shaft 3 is rotated clockwise and the upper metal fitting 4 is rotated to the position at which it is engaged with the engaging aperture Fa inside the lower corner fitting F. During this, the stopper 24 is protruded from the upper face of the upper fitting portion 22 by the biasing force of the spring by the rotation of the upper metal fitting 4 to the position at which it is engaged with the engaging aperture Fa of the corner fitting F and, after this, the upper metal fitting 4 abuts against the stopper 24, is prevented from rotating counterclockwise by the biasing force of the torsion spring 34 any more and is held at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F. Therefore, even if a hand holding the container coupling metal joint 1 leaves it, the container coupling metal joint 1 is securely prevented from falling down from the lower corner fitting F of the container Ct since the upper metal fitting 4 is engaged with the engaging aperture Fa of the lower corner fitting F.

[0084] At this moment, the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23. The container coupling metal joint 1 descends due to its own weight and the cutouts 4x of the upper metal fitting 4 contact the inner peripheral surface of the engaging aperture Fa of the lower corner fitting F and are held there as well as the upper fitting portion 22 is partially engaged with the engaging aperture Fa of the lower corner fitting F (see Fig. 11).

[0085] When the container coupling metal joint 1 has been attached as a result of engagement of the upper metal fitting 4 with the engaging aperture Fa of the lower corner fitting F of the container Ct, the container Ct is lifted up using the container crane Cr and is loaded on the container ship Sh. During this, since the upper metal fitting 4 is at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F of the container Ct that is lifted up, being limited by the stopper 24 as described above, the container coupling metal joint 1 can not fall off from the lower corner fitting F of the container Ct while the container Ct is moved from the Apron to the deck of the container ship Sh.

[0086] On the other hand, since the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23, the lower metal fitting 5 can be inserted into the upper corner fitting F through the engaging aperture Fa of the upper corner fitting F of the lower container Ct loaded earlier. At this moment, the lower fitting portion 23 is engaged with the engaging aperture Fa of the upper corner fitting F (see Fig. 12).

[0087] Further descending of the upper container Ct allows the lower face of the main body portion 21 of the

joint main body 2 to be placed on the upper face of the upper corner fitting F of the lower container Ct, after which the upper container Ct descends by the height corresponding to the height of the cutouts 4x of the upper metal fitting 4. Since, at this moment, the lower corner fitting F abuts against the slope of the pressing piece 61 protruding outward from the upper fitting portion 22 of the joint main body 2 and bears the weight of the upper container Ct, the pressing piece 61 is thrust in toward the second cavity 2b of the joint main body 2 along the guide aperture 61a and the guide groove 61b. On the other hand, since the pressing piece is thrust in toward the second cavity 2b of the joint main body 2, the arm 33 of the shaft 3 against which the tip of the pressing piece 61 abuts is thrust out against the biasing force of the torsion spring 34, with the result that the shaft 3 is rotated clockwise and, inside the upper corner fitting F of the lower container Ct, causes the lower metal fitting 5 to rotate to the position at which it can be engaged with the engaging aperture Fa. Similarly, the upper metal fitting 4 is also rotated to the position at which it is further engaged with the engaging aperture Fa of the lower corner fitting F of the upper container Ct (see Fig. 13). Then, finally, the lower face of the lower corner fitting F of the upper container Ct is placed on the upper face of the main body portion 21 of the joint main body 2.

[0088] Consequently, the upper and the lower containers Ct are coupled through the container coupling metal joint 1 of which the upper metal fitting 4 and the lower metal fitting 5 are respectively rotated to the respective positions at which each of them are respectively engaged with the engaging apertures Fa of the corner fittings F.

[0089] The operation lever 71 is thrust out from the housing portion 21b of the joint main body 2 to the position corresponding to the locking portion 21a through the control cable 72 connected to the shaft 3.

[0090] Under the status where the upper and the lower containers Ct are coupled through the container coupling metal joint 1, if the container ship Sh rolls and is tilted by an angle exceeding a predetermined angle relative to the horizontal plane, since, in the safety mechanism 8, one of the balls 85 rolls along the slope 8x and the moving element 83 and the ball 85 interfere with each other, the backward move of the moving element 83 can be prevented (see Fig. 7 (c) and Fig. 8 (b)).

[0091] That is, even when the lower corner fitting F of the container Ct is released from the pressing piece 61 due to the tilting or the jumping of the containers Ct caused by the rolling or pitching of the container ship Sh, the shaft 3 is attempted to rotate by the biasing force of the torsion spring 34 such that the lower metal fitting 5 overlaps the lower fitting portion 23. However, at this moment, since the operation lever 71 with the control cable 72 anchored to it abuts against the moving element 83 being prevented from moving backward by the ball 85, the operation lever 71 can not move.

[0092] Consequently, the shaft 3, i.e., the lower metal fitting 5 is rotated to the position at which it overlaps the

lower fitting portion 23 and the lower metal fitting 5 is released from the engaging aperture Fa of the upper corner fitting F of the lower container Ct. Therefore, the coupled status of the upper and the lower containers Ct by the container coupling metal joint 1 is securely prevented from being released.

[0093] For example, when stormy weather is expected during a voyage, it is necessary to rotate the operation lever 71 at the position corresponding to the locking portion 21a of the joint main body 2, by 90 degrees to lock with the locking portion 21a (see the position indicated by the dotted line in Fig. 1 and Fig. 7 (d)) and, by doing so, counterclockwise rotation of the shaft 3 caused by the biasing force of the torsion spring 34 can be prevented. However, even though the operation for rotating the operation lever 71 is forgotten, the upper metal fitting 5 can be securely prevented from being released from the engaging aperture Fa of the upper corner fitting F of the lower container Ct by preventing the counterclockwise rotation by the torsion spring 34 of the shaft 3 by the safety mechanism 8.

[0094] On the other hand, when the container Ct is unloaded from the container ship Sh, it is enough that the container Ct is lifted up through the container crane Cr. That is, when the upper container Ct is lifted up, first, only the upper container Ct is lifted up by the height of the cutouts 4x of the upper metal fitting 4. During this, the shaft 3 is rotated counterclockwise by the biasing force of the torsion spring 34 due to releasing off of the lower corner fitting Fa of the upper container Ct from the slope of the pressing piece 61 and the pressing piece 61 is thrust out by the arm 33. That is, the shaft is rotated counterclockwise by the biasing force of the torsion spring 34 to the position at which the upper metal fitting 4 abuts against the stopper 24. At this moment, the container coupling metal joint 1 can be released from the upper corner fitting F of the lower container Ct since the upper metal fitting 5 is at the position at which it overlaps the lower fitting portion 23 (see Fig. 14).

[0095] In this way, the lower metal fitting 5 of the container coupling metal joint 1 can be securely released from the upper corner fitting F of the lower container Ct by only lifting up the upper container Ct. Therefore, the operation of operation tools by workers or work at high places are unnecessary. In this case, as described before, the upper metal fitting 4 is at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F of the lifted container Ct. Therefore, the container coupling metal joint 1 can not fall off from the lower corner fitting F of the container Ct during the transfer of it from the container ship Sh to the apron Ap.

[0096] When the container Ct has been transferred to the apron Ap, once the operation rod 241 is pressed down on the apron Ap, the shaft 3 is rotated counterclockwise by the biasing force of the torsion spring 34 since the stopper 24 is retreated inside the joint main body 2, and the upper metal fitting 4 is rotated to the position at which it overlaps the upper fitting portion 22. Therefore, the up-

per metal fitting 4 together with the upper fitting portion 22, i.e., the container coupling metal joint 1 can be released from the engaging aperture Fa of the lower corner fitting F of the container Ct.

[0097] In the embodiment described above, a case is described where the upper metal fitting 4 is held at the position it is engaged with the engaging aperture Fa of the lower corner fitting F of the container Ct by providing the stopper 24 and causing the upper metal fitting 4 to abut against the stopper 24. However, it is possible to adapt that, instead of the stopper 24 or with the stopper 24, at the front end of the joint main body 2 and front end of the safety mechanism 8, a second locking portion intersecting the housing portion 21b and 8b at a right angle and having a groove-like shape with a depth slightly shallower than the depth of the housing portion 21b and 8b is formed to lock the operation lever 71 at the new second locking portion and the upper metal fitting 4 is held at the position at which it is engaged with the engaging aperture Fa of the corner fitting F of the container Ct.

[0098] Figs. 15 and 16 show a second embodiment of the container coupling metal joint 1 of the invention.

[0099] For describing the second embodiment of the container coupling metal joint 1, the same reference numbers are given to the members same as the members constituting the first embodiment of the container coupling metal joint 1 described above. The detailed description for those members is omitted and only the rotation mechanism 6 and the safety mechanism 8 that differ from those of the first embodiment will be described.

[0100] The rotation mechanism 6 in this container coupling metal joint 1, comprises an ascending/descending member 62 provided on the main body portion 21 of the joint main body 2, being capable of being protruded and retreated and an articulated link 63, such as a chain, having a plurality of articulated points arranged below the ascending/descending member 62 in a housing space formed in the main body portion 21 of the joint main body 2, communicating with the cavity 2f. At the each articulated point of the articulated link 63, a spring not shown is provided and the articulated link 63 is urged in the direction it is articulated. The tip of the articulated link 63 is protruded into the cavity 2f of the joint main body 2 through the housing space and the top of the tip abuts against an engaged portion 3a formed in the shaft 3. The ascending/descending member 62 is protruded above the upper face of the main body portion 21 of the joint main body 2 by the articulated link 63 that is articulated.

[0101] On the other hand, the safety mechanism 8 comprises a pair of inclined paths 2x that are declining and formed extending in the direction of the diameter of the through hole 2d and, of which one end opens to the cavity 2f of the joint main body 2, a plurality of balls 85 as rolling elements arranged in such a manner as to be able to roll on each inclined path 2x and a pair of fitted recesses 3x formed in the shaft 3 corresponding to each opening of the inclined paths 2x. When the shaft 3 is rotated by a predetermined angle by the articulated link

63 that is stretched, each inclined path 2x of the joint main body and each fitted recess 3x of the shaft 3 are set to respectively communicate with each other.

[0102] The inclined paths 2x are provided being spaced by 180 degrees from each other at positions shifted by a predetermined angle such that they do not interfere with the housing space housing the articulated link 63.

[0103] Next, the action of the second embodiment of the container coupling metal joint 1 structured as described above will be described.

[0104] First, in the initial status, the upper metal fitting 4 is at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F of the container Ct by being struck against by the stopper 24. At this moment, the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23 of the joint main body 2. The ascending/descending member 62 is at its raised position by the biasing force of the articulated link 63 that is articulated, and is protruded above the upper face of the main body portion 21 of the joint main body 2.

[0105] In order to attach the container coupling metal joint 1 in the engaging aperture Fa of the corner fitting F of the container Ct, first, the stopper 24 is retreated inside the joint main body 2 by pressing down the operation rod 241. During this, the shaft 3 is rotated by the biasing force of the torsion spring 34 to the position at which the upper metal fitting 4 overlaps the upper fitting portion 22. Therefore, the operation lever 71 is drawn backward through the control cable 72 by the distance created by the rotation of the shaft 3, abuts against the end of the depth of the housing portion 21b of the joint main body 2 and is housed there.

[0106] Under this status, the container coupling metal joint 1 is lifted and the upper metal fitting 4 is inserted into the lower corner fitting F through the engaging aperture Fa of the lower corner fitting F of the container Ct that is lifted up. After this, by drawing the operation lever 71 against the biasing force of the torsion spring 34, the shaft 3 is rotated clockwise and the upper metal fitting 4 is rotated in the lower corner fitting F to the position at which it can be engaged with the engaging aperture Fa. During this, the stopper 24 is protruded from the upper face of the upper fitting portion 22 by the biasing force of the spring. After this, the upper metal fitting 4 abuts against the stopper 24, is prevented from rotating counterclockwise any more and is held at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F.

[0107] In this case, the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23. The container coupling metal joint 1 descends due to its own weight and the cutouts 4x of the upper metal fitting 4 contact the inner peripheral surface of the engaging aperture Fa of the lower corner fitting F and are held there as well as the upper fitting portion 22 is partially engaged with the engaging aperture Fa of the lower corner fitting F.

[0108] When the container coupling metal joint 1 has been attached as a result of engagement of the upper metal fitting 4 with the engaging aperture Fa of the lower corner fitting F of the container Ct, the container Ct is lifted up using the container crane Cr and is loaded on the container ship Sh. At this moment, since the upper metal fitting 4 is at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F of the container Ct that is lifted up, the container coupling metal joint 1 can not fall off from the lower corner fitting F of the container Ct while the container Ct is moved from the Apron to the deck of the container ship Sh.

[0109] On the other hand, since the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23, the lower metal fitting 5 can be inserted into the upper corner fitting F through the engaging aperture Fa of the upper corner fitting F of the lower container Ct loaded earlier. At this moment, the lower fitting portion 23 is engaged with the engaging aperture Fa of the upper corner fitting F.

[0110] After the upper container Ct has been lowered further and the lower face of the main body portion 21 of the joint main body 2 has been placed on the upper face of the upper corner fitting F of the lower container Ct, the upper container Ct descends by the height corresponding to the height of the cutouts 4x of the upper metal fitting 4. Since, during this, the lower corner fitting F abuts against the ascending/descending member 62 protruding upward from the main body portion 21 of the joint main body 2 and bears the weight of the upper container Ct, the ascending/descending member 62 is pressed down. Once the ascending/descending member 62 has lowered, the articulated link 63 is stretched and its tip abuts against and thrusts out the engaged portion 3a. Therefore, the shaft 3 is rotated clockwise against the biasing force of the torsion spring 34 and, inside the upper corner fitting F of the lower container Ct, causes the lower metal fitting 5 to rotate to the position at which it is engaged with the engaging aperture Fa. Similarly, the upper metal fitting 4 is also rotated to the position at which it is further engaged with the engaging aperture Fa of the lower corner fitting F of the upper container Ct. Then, finally, the lower face of the lower corner fitting F of the upper container Ct is placed on the upper face of the main body portion 21 of the joint main body 2. At this moment, the balls 85 face the fitted recesses 3x of the shaft 3 since the fitted recesses 3x of the shaft 3 that has been rotated communicate with the openings of the inclined paths 2x.

[0111] Consequently, the upper and the lower containers Ct are coupled through the container coupling metal joint 1 of which the upper metal fitting 4 and the lower metal fitting 5 are respectively rotated to the respective positions at which each of them are respectively engaged with the engaging apertures Fa of the corner fittings F.

[0112] Under the status where the upper and the lower containers Ct are coupled through the container coupling metal joint 1, if the container ship Sh rolls and is tilted by an angle exceeding a predetermined angle relative to the

horizontal plane, since, in the safety mechanism 8, one of the balls 85 rolls along the inclined paths 2x and it bridges the fitted recess 3x of the shaft 3 and the inclined path 2x of the joint main body 2, the rotation of the shaft 3 can be prevented.

[0113] That is, even when the lower corner fitting F of the container Ct is released from the ascending/descending member 62 due to the tilting or the jumping of the containers Ct caused by the rolling or pitching of the container ship Sh, the rotation of the shaft 3 is prevented by the ball 85. Therefore, the shaft 3 can not be rotated by the biasing force of the torsion spring 34 to the position at which the lower metal fitting 5 overlaps the lower fitting portion 23.

[0114] Consequently, the lower metal fitting 5, i.e., the container coupling metal joint 1 can be prevented from being released from the engaging aperture Fa of the upper corner fitting F of the lower container Ct and the coupled status of the upper and the lower containers Ct by the container coupling metal joint 1 can be securely prevented from being released.

[0115] On the other hand, when the container Ct is unloaded from the container ship Sh, it is enough that the container Ct is lifted up through the container crane Cr. That is, when the upper container Ct is lifted up, first, only the upper container Ct ascends by the height of the cutouts 4x of the upper metal fitting 4. During this, since the lower corner fitting Fa of the upper container Ct is released from the ascending/descending member 62, the shaft 3 is rotated counterclockwise to the position at which the upper metal fitting 4 abuts against the stopper 24 by the biasing force of the torsion spring 34. At this moment, since the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23, the lower metal fitting 5 can release the container coupling metal joint 1 from the upper corner fitting F of the lower container Ct. Furthermore, since the lower metal fitting 5 thrusts back the tip of the articulated link 63 through the engaged portion 3a of the shaft 3, it articulates the articulated link 63 cooperating with the biasing force of the torsion spring and the ascending/descending member 62 is thrust up.

[0116] In this way, the lower metal fitting 5 of the container coupling metal joint 1 can be securely released from the upper corner fitting F of the lower container Ct by only lifting up the upper container Ct. Therefore, the operation of operation tools by workers or work at high places are unnecessary. In this case, the upper metal fitting 4 is at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F of the lifted container Ct. Therefore, the container coupling metal joint 1 can not fall off from the lower corner fitting F of the container Ct during the transfer of it from the container ship Sh to the apron Ap.

[0117] When the container Ct has been transferred to the apron Ap, once the operation rod 241 is pressed down on the apron Ap, the shaft 3 is rotated counterclockwise by the biasing force of the torsion spring 34 since the stopper 24 is retreated inside the joint main body 2, and

the upper metal fitting 4 is rotated to the position at which it overlaps the upper fitting portion 22. Therefore, the upper metal fitting 4 together with the upper fitting portion 22, i.e., the container coupling metal joint 1 can be released from the engaging aperture Fa of the lower corner fitting F of the container Ct.

[0118] A third embodiment of the container coupling-metal joint 1 is shown in Figs. 17 to 19.

[0119] Similarly for describing the third embodiment of the container coupling metal joint 1, the same reference numbers are given to the members same as the members constituting the first embodiment of the container coupling metal joint 1 described above. The detailed description for those members is omitted and only the rotation mechanism 6 and the safety mechanism 8 that differ from those of the first embodiment will be described.

[0120] The rotation mechanism 6 of the container coupling metal joint 1 comprises a guide path 21d formed communicating with the cavity 2f from upward to the cavity 2f, in the main body portion 21 of the joint main body 2 and a sliding member 64 slidably housed in the guide path 21d. The tip of the sliding member 64 is protruded into the cavity 2f through the guide path 21d and abuts against the engaged portion 3a of the shaft 3. The upper end of the sliding member 64 is protruded beyond the upper face of the main body portion 21 of the joint main body 2.

[0121] On the other hand, the safety mechanism 8 comprises a pair of fitted recesses 2y formed being spaced by 180 degrees to each other on the inner peripheral surface of the cavity 2f of the joint main body 2, a pair of declining inclined paths 3y with their respective one ends opening to the outer peripheral surface of the shaft 3 being spaced by 180 degrees, formed toward the center from the openings and balls 85 as rollers arranged capable of rolling freely in each inclined path 3y. It is arranged that each inclined path 3y of the shaft 3 and each fitted recess 2y of the joint main body 2 are respectively in communication with each other when the shaft 3 is at a position where it has been rotated by the sliding member 64 by a predetermined angle.

[0122] Next, the action of the third embodiment of the container coupling metal joint 1 structured as described above will be described.

[0123] First, in the initial status, the upper metal fitting 4 is struck against by the stopper 24 and is at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F of the container Ct and, at this moment, the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23 of the joint main body 2. The sliding member 64 abuts against the engaged portion 3a of the shaft 3 and is thrust up along the guide path 21d, and the tip of the sliding member 64 is protruded from the upper face of the main body portion 21 of the joint main body 2.

[0124] In order to attach the container coupling metal joint 1 to the engaging aperture Fa of the corner fitting F of the container Ct, first, the stopper 24 is caused to re-

treat inside the joint main body 2 by pressing down the operation rod 241. During this, the shaft 3 is rotated to the position at which the upper metal fitting 4 overlaps the upper fitting portion 22 by the biasing force of the torsion spring 34. Therefore, the operation lever 71 is drawn backward through the control cable 72 by the distance created by the rotation of the shaft 3, and is housed in the housing portion 21b of the joint main body 2 striking against the end of the depth of the housing portion 21b. The engaged portion 3a of the shaft 3 does not influence the sliding member 64 since it rotates where it abuts against the tip of the sliding member 64.

[0125] Under this status, the upper metal fitting 4 is inserted into the lower corner fitting F through the engaging aperture Fa of the lower corner fitting F of the container Ct that is lifted up, by lifting up the container coupling metal joint 1. Following this, once the operation lever 71 is drawn against the biasing force of the torsion spring 34, the shaft 3 is rotated clockwise and the upper metal fitting 4 is rotated to the position at which it is engaged with engaging aperture Fa inside the lower corner fitting F. During this, the stopper 24 is protruded from the upper face of the upper fitting portion 22 by the biasing force of the spring, after this, the upper metal fitting 4 abuts against the stopper 24, is prevented from rotating counterclockwise any more and is held at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F.

[0126] In this case, the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23. The container coupling metal joint 1 descends due to its own weight and the cutouts 4x of the upper metal fitting 4 contact the inner peripheral surface of the engaging aperture Fa of the lower corner fitting F and are held there as well as the upper fitting portion 22 is partially engaged with the engaging aperture Fa of the lower corner fitting F.

[0127] When the container coupling metal joint 1 has been attached as a result of engagement of the upper metal fitting 4 with the engaging aperture Fa of the lower corner fitting F of the container Ct, the container Ct is lifted up using the container crane Cr and is loaded on the container ship Sh. During this, since the upper metal fitting 4 is at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F of the container Ct being lifted up, the container coupling metal joint 1 can not fall off from the lower corner fitting F of the container Ct while the container Ct is transferred from the Apron to the deck of the container ship Sh.

[0128] On the other hand, since the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23, the lower metal fitting 5 can be inserted into the upper corner fitting F through the engaging aperture Fa of the upper corner fitting F of the lower container Ct loaded earlier. At this moment, the lower fitting portion 23 is engaged with the engaging aperture Fa of the upper corner fitting F.

[0129] After the upper container Ct has been lowered further and the lower face of the main body portion 21 of

the joint main body 2 has been placed on the upper face of the upper corner fitting F of the lower container Ct, the upper container Ct descends by the height corresponding to the height of the cutouts 4x of the upper metal fitting 4. Since, during this, the lower corner fitting F abuts against the sliding member 64 protruding upward from the main body portion 21 of the joint main body 2 and bears the weight of the upper container Ct, the sliding member 64 is thrust and slid along the guide path 21d. Once the sliding member 64 has slid along the guide path 21d, the tip of it abuts against the engaged portion 3a of the shaft 3 and thrusts the engaged portion 3a against the biasing force of the torsion spring 34. Therefore, the shaft is rotated clockwise and the lower metal fitting 5 is rotated to the position at which it is engaged with the engaging aperture Fa. Similarly, the upper metal fitting 4 is also rotated to the position it is further engaged with the engaging aperture Fa of the lower corner fitting F of the upper container Ct. Then, finally, the lower face of the lower corner fitting F of the upper container Ct is placed on the upper face of the main body portion 21 of the joint main body 2. At this moment, the fitted recesses 2y of the joint main body 2 are faced with the balls 85 since each inclined path 3y of the rotated shaft 3 and the fitted recess 2y of the joint main body 2 communicates with each other (see Fig. 19).

[0130] Consequently, the upper and the lower containers Ct are coupled through the container coupling metal joint 1 of which the upper metal fitting 4 and the lower metal fitting 5 are respectively rotated to the respective positions at which each of them are respectively engaged with the engaging apertures Fa of the corner fittings F.

[0131] Under the status where the upper and the lower containers Ct are coupled through the container coupling metal joint 1, if the container ship Sh rolls and is tilted by an angle exceeding a predetermined angle relative to the horizontal plane, since, in the safety mechanism 8, one of the balls 85 rolls along the inclined path 3y and the ball 85 is positioned bridging the inclined path 3y of the shaft 3 and the fitted recess 2y of the joint main body 2, the shaft is prevented from rotating (see the position shown by the dotted line in Fig. 19).

[0132] That is, even if the lower corner fitting F of the container Ct is released from the sliding member 64 due to the tilting or the jumping of the containers Ct caused by the rolling or pitching of the container ship Sh, the shaft 3 is not rotated by the biasing force of the torsion spring 34 to the position at which the lower metal fitting 5 overlaps the lower fitting portion 23 since the shaft 3 is prevented from rotating by the ball 85.

[0133] Consequently, the coupled status of the upper and the lower containers Ct by the container coupling metal joint 1 is securely prevented from being released by releasing of the lower metal fitting 5, i. e., the container coupling metal joint 1 from the engaging aperture Fa of the upper corner fitting F of the lower container Ct.

[0134] On the other hand, when the container Ct is unloaded from the container ship Sh, it is enough that

the container Ct is lifted up through the container crane Cr. That is, when the upper container Ct is lifted up, first, only the upper container Ct is lifted up by the height of the cutouts 4x of the upper metal fitting 4. During this, the shaft 3 is rotated counterclockwise to the position at which the upper metal fitting 4 abuts against the stopper 24 by the biasing force of the torsion spring 34 due to releasing off of the lower corner fitting Fa of the upper container Ct from the sliding member 64. At this moment, the container coupling metal joint 1 can be released from the upper corner fitting F of the lower container Ct since the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23. At this moment, the sliding member 64 is thrust up along the guide path 21d since the tip of the sliding member 64 is thrust back through the engaged portion 3a of the shaft 3.

[0135] In this way, the lower metal fitting 5 of the container coupling metal joint 1 can be securely released from the upper corner fitting F of the lower container Ct by only lifting up the upper container Ct. Therefore, the operation of operation tools by workers or work at high places are unnecessary. In this case, the upper metal fitting 4 is at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F of the lifted container Ct. Therefore, the container coupling metal joint 1 can not fall off from the lower corner fitting F of the container Ct during the transfer of it from the container ship Sh to the apron Ap.

[0136] When the container Ct has been transferred to the apron Ap, once the operation rod 241 is pressed down on the apron Ap, the shaft 3 is rotated counterclockwise by the biasing force of the torsion spring 34 since the stopper 24 is retreated inside the joint main body 2, and the upper metal fitting 4 is rotated to the position at which it overlaps the upper fitting portion 22. Therefore, the upper metal fitting 4 together with the upper fitting portion 22, i.e., the container coupling metal joint 1 can be released from the engaging aperture Fa of the lower corner fitting F of the container Ct.

[0137] Furthermore, a fourth embodiment of the container coupling metal joint 1 of the invention is shown in Figs. 20 and 21.

[0138] Similarly for describing the fourth embodiment of the container coupling metal joint 1, the same reference numbers are given to the members same as the members constituting the first embodiment of the container coupling metal joint 1 described above. The detailed description for those members is omitted and only the rotation mechanism 6 and the safety mechanism 8 that differ from those of the first embodiment will be described.

[0139] The rotation mechanism 6 of the container coupling metal joint 1 comprises an ascending/descending member 65 fitted capable of ascending/descending along the outer peripheral surface of the shaft 3, a spring 66 for urging the ascending/descending member 65 to its raised position and a spiral groove 3z formed on the outer peripheral surface of the shaft 3. On the outer pe-

ripheral surface of the ascending/descending member 65, a pair of operation portions 651 is extended outward each shifted by 180 degrees to each other and the tips of the operation portions 651 are protruded beyond the upper face of the main body portion 21 of the joint main body 2. A pin 652 to be fitted in the spiral groove 3z of the shaft 3 is provided on the ascending/descending member 65.

[0140] On the other hand, the safety mechanism 8 comprises a pair of inclined paths 2x that are declining and formed extending in the direction of the diameter of the through hole 2d and, of which one end opens to the cavity 2f of the joint main body 2, a plurality of balls 85 as rolling elements arranged rollably on each inclined path 2x and a pair of fitted recesses 65x formed being spaced by 180 degrees in the ascending/descending member 65 corresponding to each opening of the inclined paths 2x. It is arranged that each inclined path 2x of the joint main body 2 and each fitted recess 65x of the ascending/descending member 65 do not communicate with each other when the ascending/descending member 65 is at its raised position by the biasing force of a spring 66 while each inclined path 2x of the joint main body 2 and each fitted recess 65x of the ascending/descending member 65 communicate with each other when the ascending/descending member 65 is at its lowered position against the biasing force of the spring 66.

[0141] The inclined paths 2x and the fitted recesses 65x are provided being spaced by 180 degrees at respective positions shifted by a predetermined angle such that they do not interfere with an operation portion 651.

[0142] The main body portion 21 of the joint main body 2 is provided with a pressing member 67 capable of protruding and retreating and urged such that it protrudes from the upper face of the main body portion 21 through a spring 68. When the pressing member 67 is at its raised position by the biasing force of the spring 68, balls 85 are housed in the inclined paths 2x and, when the pressing member 67 is at its lowered position against the biasing force of the spring 68, balls 85 are respectively thrust out along each of the inclined paths 2x and it is arranged that the ball 85 running ahead at this moment is housed in the fitted recess 65x of the ascending/descending member 65. In this case, the height of the protruding of the pressing member 67 from the upper face of the main body portion 21 of the joint main body 2 is set to become smaller than the height of the protruding of the operation portion 651 of the ascending/descending member 65.

[0143] Next, the action of the fourth embodiment of the container coupling metal joint 1 structured as described above will be described.

[0144] First, at the initial status, the upper metal fitting 4 is caused to abut against the stopper 24 and is at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F of the container Ct. At this moment, the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23 of the joint main body 2. The ascending/descending member 65 is

at its raised position by the biasing force of the spring 66 and its operation portion 651 is protruded upward from the upper face of the main body portion 21 of the joint main body 2. Furthermore, the operation lever 71 is housed in the housing portion 21b of the joint main body 2 remaining some room to the end of the depth of the housing portion 21b.

[0145] In order to attach the container coupling metal joint 1 to the engaging aperture Fa of the corner fitting F of the container Ct, first, the stopper 24 is caused to retreat inside the joint main body 2 from the position at which it is protruded from the upper face of the upper fitting portion 22 by pressing down the operation rod 241 against the biasing force of the spring. During this, the shaft 3 is rotated by the biasing force of the torsion spring 34 to the position at which the upper metal fitting 4 overlaps the upper fitting portion 22. Thereby, the operation lever 71 is drawn backward through the control cable 72 by the distance created by the rotation of the shaft 3, and is housed in the housing portion 21b of the joint main body 2 striking against the end of the depth of the housing portion 21b. The spiral groove 3z does not interfere with the pin 652 of the ascending/descending member 65 and the ascending/descending member 65 is not raised due to the rotation of the shaft 3.

[0146] Under this status, the upper metal fitting 4 is inserted into the lower corner fitting F through the engaging aperture Fa of the lower corner fitting F of the container Ct that is lifted up, by lifting up the container coupling metal joint 1. Following this, once the operation lever 71 is drawn, the shaft 3 is rotated clockwise and the upper metal fitting 4 is rotated to the position at which it is engaged with the engaging aperture Fa inside the lower corner fitting F. During this, the stopper 24 is protruded from the upper face of the upper fitting portion 22 by the biasing force of the spring and, after this, the upper metal fitting 4 abuts against the stopper 24, is prevented from rotating counterclockwise any more and is held at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F. The relation of positions of the spiral groove 3z of the shaft 3 and the ascending/descending member 65 is recovered as shown in Fig. 20 by the clockwise rotation of the shaft 3 by a predetermined angle.

[0147] In this case, the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23. The container coupling metal joint 1 descends due to its own weight and the cutouts 4x of the upper metal fitting 4 contact the inner peripheral surface of the engaging aperture Fa of the lower corner fitting F and are held there as well as the upper fitting portion 22 is partially engaged with the engaging aperture Fa of the lower corner fitting F.

[0148] When the container coupling metal joint 1 has been attached as a result of engagement of the upper metal fitting 4 with the engaging aperture Fa of the lower corner fitting F of the container Ct, the container Ct is lifted up using the container crane Cr and is loaded on the container ship Sh. During this, since the upper metal

fitting 4 is at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F of the container Ct that is lifted up, the container coupling metal joint 1 can not fall off from the lower corner fitting F of the container Ct while the container Ct is transferred from the Apron to the deck of the container ship Sh.

[0149] On the other hand, since the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23, the lower metal fitting 5 can be inserted into the upper corner fitting F through the engaging aperture Fa of the upper corner fitting F of the lower container Ct loaded earlier. At this moment, the lower fitting portion 23 is engaged with the engaging aperture Fa of the upper corner fitting F.

[0150] After the upper container Ct has been lowered further and the lower face of the main body portion 21 of the joint main body 2 has been placed on the upper face of the upper corner fitting F of the lower container Ct, the upper container Ct descends by the height corresponding to the height of the cutouts 4x of the upper metal fitting 4. Since, during this, the lower corner fitting F abuts against the operation portion 651 of the ascending/descending member 65 protruding upward from the main body portion 21 of the joint main body 2 and bears the weight of the upper container Ct, the ascending/descending member 65 is pressed down along the shaft 3 through the operation portion 651. When the ascending/descending member 65 is lowered against the biasing force of the spring 66, the pin 652 provided on the ascending/descending member 65 is also lowered pressing downward the spiral groove 3z of the shaft 3. Therefore, the shaft 3 is rotated clockwise and, inside the upper corner fitting F of the lower container Ct, causes the lower metal fitting 5 to rotate to the position at which it is engaged with the engaging aperture Fa. Similarly, the upper metal fitting 4 is also rotated to the position at which it is further engaged with the engaging aperture Fa of the lower corner fitting F of the upper container Ct. Then, finally, the lower face of the lower corner fitting F of the upper container Ct is placed on the upper face of the main body portion 21 of the joint main body 2.

[0151] On the other hand, while the container Ct is being lowered, the lower corner fitting F abuts against the operation portion 651 of the ascending/descending member 65 and starts to press down the ascending/descending member 65 along the shaft 3, then, following this, the lower corner fitting F also abuts against the pressing member 67 and starts to press down the pressing member 67 against the biasing force of the spring 68. Therefore, the balls 85 arranged in the inclined path 2x are thrust up along the inclined path 2x by the pressing member 67 and causes the ball 85 ahead to be housed in the fitted recess 65x of the ascending/descending member 65 having already started to descend. In this case, the ball 85 is prevented from returning by the thrusting body 67.

[0152] Consequently, the upper and the lower containers Ct are coupled through the container coupling metal

joint 1 of which the upper metal fitting 4 and the lower metal fitting 5 are respectively rotated to the respective positions at which each of them are respectively engaged with the engaging apertures Fa of the corner fittings F.

[0153] The operation lever 71 is thrust out from and to the positions corresponding respectively to the housing portion 21b of the joint main body 2 and locking portion 21a through the control cable 72 connected to the shaft 3.

[0154] Under the status where the upper and the lower containers Ct are coupled through the container coupling metal joint 1, if the container ship Sh rolls and is tilted by an angle exceeding a predetermined angle relative to the horizontal plane, since, in the safety mechanism 8, one of the balls 85 rolls along the inclined path 2x and bridges the fitted recess 65x of the ascending/descending member 65 and the inclined path 2x formed in the joint main body 2. Therefore, ascending of the ascending/descending member 65 can be prevented.

[0155] That is, even when the lower corner fitting F of the container Ct is released from the operation portion 651 due to the shaking or the jumping of the containers Ct caused by the rolling or pitching of the container ship Sh, as far as it is not released from the pressing member 67, ascending of the ascending/descending member 65 can be prevented since the ball 85 is housed in the fitted recess 65x of the ascending/descending member 65. At this moment, since clockwise rotation of the shaft 3 is caused by the ascending of the ascending/descending member 65, as far as the ascending of the ascending/descending member 65 is prevented, the lower metal fitting 5 can not be rotated by the biasing force of the torsion spring 34 to the position it overlaps the lower fitting portion 23.

[0156] Consequently, the lower metal fitting 5, i.e., the container coupling metal joint 1 can be securely prevented from being released off from the upper corner fitting F of the lower container Ct. Therefore, the coupled status of the upper and the lower containers Ct by the container coupling metal joint 1 is securely prevented from being released.

[0157] On the other hand, when the container Ct is unloaded from the container ship Sh, it is enough that the container Ct is lifted up through the container crane Cr. That is, when the upper container Ct is lifted up, first, only the upper container Ct ascends by the height of the cutouts 4x of the upper metal fitting 4. During this, since the lower corner fitting Fa of the upper container Ct starts to be released simultaneously from the pressing member 67 and the operation portion 651, first, the balls 85 roll along the inclined path 2x and get out of the fitted recess 65x of the ascending/descending member 65 and, simultaneously, the ascending/descending member 65 is caused to ascend by the biasing force of the spring 66, then, the pin 652 of the ascending/descending member 65 thrusts upward the spiral groove 3z of the shaft 3. At the same time, the shaft 3 is rotated counterclockwise by the biasing force of the torsion spring 34 to the position at which the upper metal fitting 4 abuts against the stop-

per 24. At this moment, the lower metal fitting 5 is at the position at which it overlaps the lower fitting portion 23. Therefore, the container coupling metal joint 1 can be released from the upper corner fitting F of the lower container Ct.

[0158] In this way, the lower metal fitting 5 of the container coupling metal joint 1 can be securely released from the upper corner fitting F of the lower container Ct by only lifting up the upper container Ct. Therefore, the operation of operation tools by workers or work at high places are unnecessary. In this case, the upper metal fitting 4 is at the position at which it is engaged with the engaging aperture Fa of the lower corner fitting F of the lifted container Ct. Therefore, the container coupling metal joint 1 can not fall off from the lower corner fitting F of the container Ct during the transfer of the container Ct from the container ship Sh to the apron Ap.

[0159] When the container Ct has been transferred to the apron Ap, once the operation rod 241 is pressed down on the apron Ap, the shaft 3 is rotated counterclockwise by the biasing force of the torsion spring 34 since the stopper 24 is retreated inside the joint main body 2, and the upper metal fitting 4 is rotated to the position at which it overlaps the upper fitting portion 22. Therefore, the upper metal fitting 4 together with the upper fitting portion 22, i.e., the container coupling metal joint 1 can be released from the engaging aperture Fa of the lower corner fitting F of the container Ct.

[0160] In the fourth embodiment described above, a case where the spiral groove 3z is formed on the shaft 3 while the pin 652 is provided on the ascending/descending member 65 and is fitted in the spiral groove 3z has been exemplified. However, a spiral groove may be formed on the inner peripheral surface of the ascending/descending member 65 while a pin may be provided on the shaft 3 and may be fitted in the spiral groove.

[0161] Furthermore, in the above-described embodiment, the inclined paths 2x and 3y are not limited to the case where they are formed in the direction of the diameter of the through hole 2d or in the direction in which it is extended, i.e., formed being spaced by 180 degrees, and the angle of inclination against the direction from the front to the back can be set optionally. Furthermore, the inclination of the inclined paths 2x and 3y is not limited to five (5) degrees.

INDUSTRIAL APPLICABILITY

[0162] As described above, according to the container coupling metal joint of the invention, though it has a simple structure, when it is used, by only stacking the container to be loaded, on the lower container, the container coupling metal joint can couple the both containers automatically and securely. Furthermore, the container coupling metal joint can release the lower container automatically and securely by only lifting up the upper container coupled to the lower container. Therefore, the operation of operation tools and work at high places are

unnecessary and it is beneficial in terms of operation and safety.

5 Claims

1. A container coupling metal joint comprising:

a joint main body having an upper fitting portion and a lower fitting portion capable of fitting into engaging apertures of corner fittings of containers;

a shaft pivoted rotatably to the joint main body; an upper metal fitting and a lower metal fitting connected integrally respectively to the upper end and the lower end of the shaft and capable of engaging with the engaging apertures of the corner fittings of the containers; and

an operation member for rotating the shaft, the joint main body being provided with a rotation mechanism for rotating the shaft by receiving the action of load of the container, the shaft being provided with a spring means for urging the upper metal fitting such that the upper metal fitting rotates to the position at which it overlaps the upper fitting portion, the upper metal fitting having cutouts diagonally oppositely formed at corner portions of its lower face on the side in engagement with the engaging apertures of the corner fittings of the containers, wherein

when, through the operation member, the upper metal fitting is at the position at which it comes into engagement with the engaging aperture of the corner fitting of the container, against the biasing force of the spring means, the lower metal fitting is at the position at which it overlaps the lower fitting portion, wherein

when the corner fitting of the container presses the rotation mechanism, the shaft is rotated against the biasing force of the spring means, causing the lower metal fitting to rotate to the position at which it comes into engagement with the engaging aperture of the corner fitting of the container, and wherein

when the corner fitting of the container is raised along the cutout of the upper metal fitting and is released from the rotation mechanism, the shaft is rotated by the biasing force of the spring means, causing the lower metal fitting to rotate to the position at which it overlaps the lower fitting portion.

2. The container coupling metal joint according to claim 1, wherein the rotation mechanism is a pressing piece in the shape of substantially a right triangle fitted in slidably along a guide aperture and a guide groove formed on the joint main body, and wherein the shaft is rotated by sliding of the pressing piece

pressed by the corner fitting of the container.

3. The container coupling metal joint according to claim 1, wherein the rotation mechanism includes an ascending/descending member capable of freely ascending and descending and an articulated link mechanism abutted by the ascending/descending member and urged always in such a direction that it is articulated, and wherein the shaft is rotated by stretching of the articulated link mechanism through the ascending/descending member pressed by the corner fitting of the container. 5
4. The container coupling metal joint according to claim 1, wherein the rotation mechanism is a sliding member slidable along a guide path formed on the joint main body, and wherein the shaft is rotated by sliding along the guide path of the sliding member pressed by the corner fitting of the container. 10 15
5. The container coupling metal joint according to claim 1, wherein the rotation mechanism includes an ascending/descending member capable of freely ascending and descending along the outer peripheral surface of the shaft and having an inwardly protruding pin, a spiral groove formed on the shaft and into which is fitted the pin of the ascending/descending member, and a spring urging the ascending/descending member to its raised position, and wherein the shaft is rotated by descending of the ascending/descending member pressed by the corner fitting of the container. 20 25 30
6. The container coupling metal joint according to claim 1, wherein the rotation mechanism includes an ascending/descending member capable of freely ascending and descending along the outer peripheral surface of the shaft and having a spiral groove formed on its inner peripheral surface, a pin disposed on the shaft and fitted into the spiral groove of the ascending/descending member, and a spring urging the ascending/descending member to its upper position, and wherein the shaft is rotated by descending of the ascending/descending member pressed by the corner fitting of the container. 35 40 45
7. The container coupling metal joint according to claim 1, wherein the operation member includes an operation lever and a connector with its one end connected to the operation lever and with the other end connected to the shaft, and wherein the joint main body is formed with a locking portion capable of locking the operation lever and a housing portion capable of housing the operation lever. 50
8. The container coupling metal joint according to claim 1, wherein the upper fitting portion of the joint main body is provided at its one corner portion a stopper 55

urged in such a direction that it protrudes from the upper face thereof and capable of freely protruding and retreating, the upper metal fitting being abutted against the stopper so that the upper metal fitting is held at a position at which it is engaged with the engaging aperture of the corner fitting of the container.

9. The container coupling metal joint according to any one of claims 1 to 8, wherein the joint main body is provided with a safety mechanism for preventing the rotation of the shaft by the biasing force of the spring means when the container coupling metal joint is tilted by a predetermined angle relative to the horizontal plane. 10
10. The container coupling metal joint according to claim 9, wherein the safety mechanism includes a receptacle main body formed in the joint main body, a lid body covering the upper opening of the receptacle main body, a moving element provided capable of freely moving back and forth with respect to the receptacle main body, the moving element being penetrated by the connector and abutted by the operation lever, and a rolling element capable of freely rolling and arranged on an outward declined slope formed on the receptacle main body, and wherein when the safety mechanism is tilted by an angle exceeding a predetermined angle, movement of the moving element is prevented by the rolling element. 20 25 30
11. The container coupling metal joint according to claim 9, wherein the safety mechanism includes an inclined path declining outward formed on the joint main body, a rolling element capable of freely rolling and arranged on the inclined path, and a fitted recess formed on the shaft, and wherein when the shaft is at the position at which it is rotatable by the articulated mechanism stretched, the inclined path of the joint main body and the fitted recess of the shaft communicate with each other and, under this status, in the case where the safety mechanism is tilted by an angle exceeding a predetermined angle, rotation of the shaft being prevented by fitting of the rolling element into the fitted recess. 35 40 45
12. The container coupling metal joint according to claim 9, wherein the safety mechanism includes an inclined path climbing outward formed on the shaft, a rolling element capable of freely rolling arranged on the inclined path, and a fitted recess formed on the joint main body, and wherein when the shaft is at the position at which it is rotatable by the sliding member slid, the inclined path of the shaft and the fitted recess of the joint main body communicate with each other and, under this status, in the case where the safety mechanism is tilted by an angle exceeding a predetermined angle, rotation of the shaft being prevented 50 55

by fitting of the rolling element into the fitted recess.

13. A container coupling metal joint according to claim 9, wherein the safety mechanism includes an inclined path declining outward formed on the joint main body, a rolling element capable of rolling and arranged on the inclined path, and a fitted recess formed on the ascending/descending member, and wherein when the ascending/descending member is at its lowered position, the inclined path of the joint main body and the fitted recess of the ascending/descending member communicate with each other and, under this status, in the case where the safety mechanism is tilted by an angle exceeding a predetermined angle, ascending of the ascending/descending member being prevented by fitting of the rolling element into the fitted recess.

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Fig.1

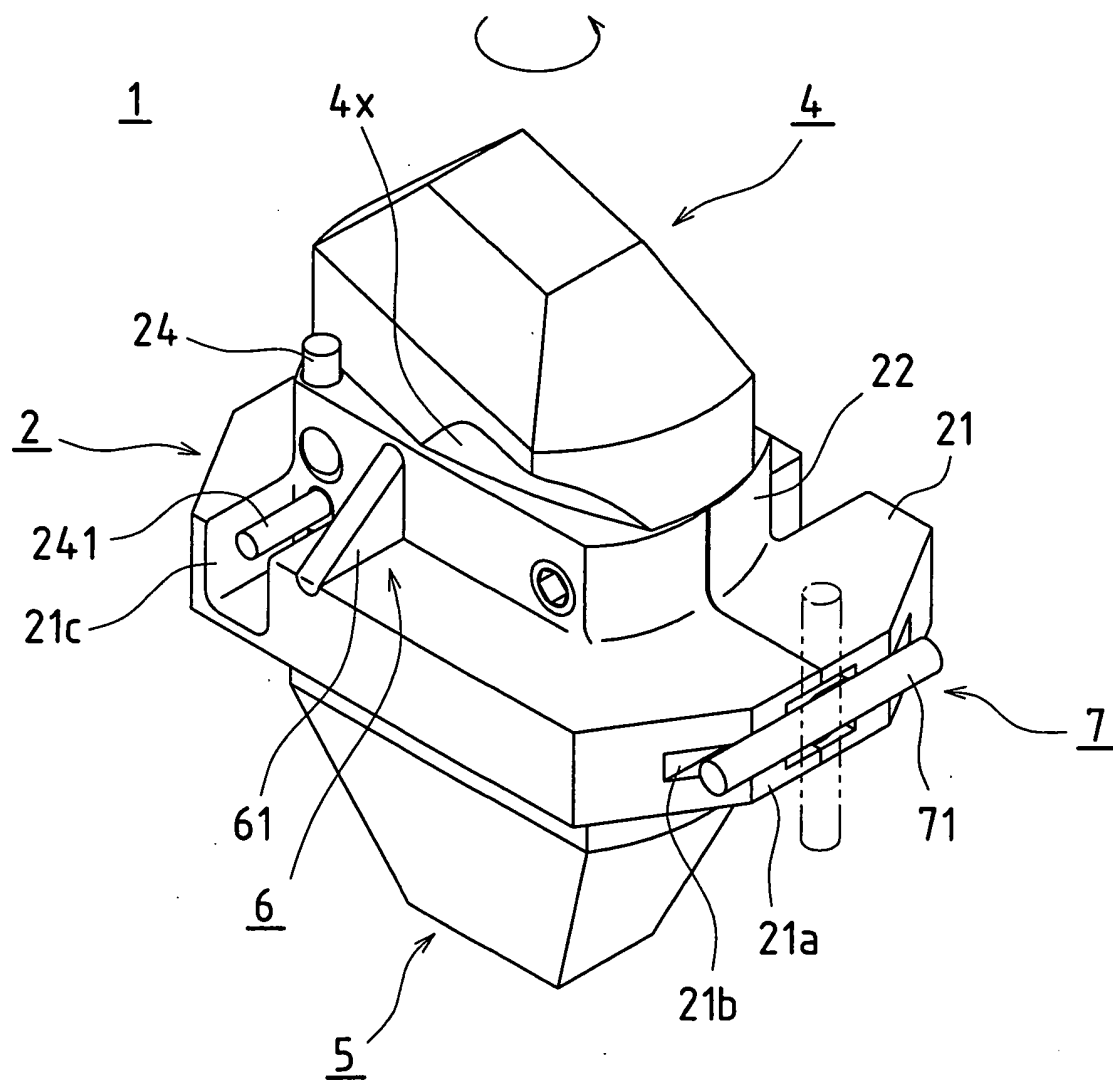


Fig.2

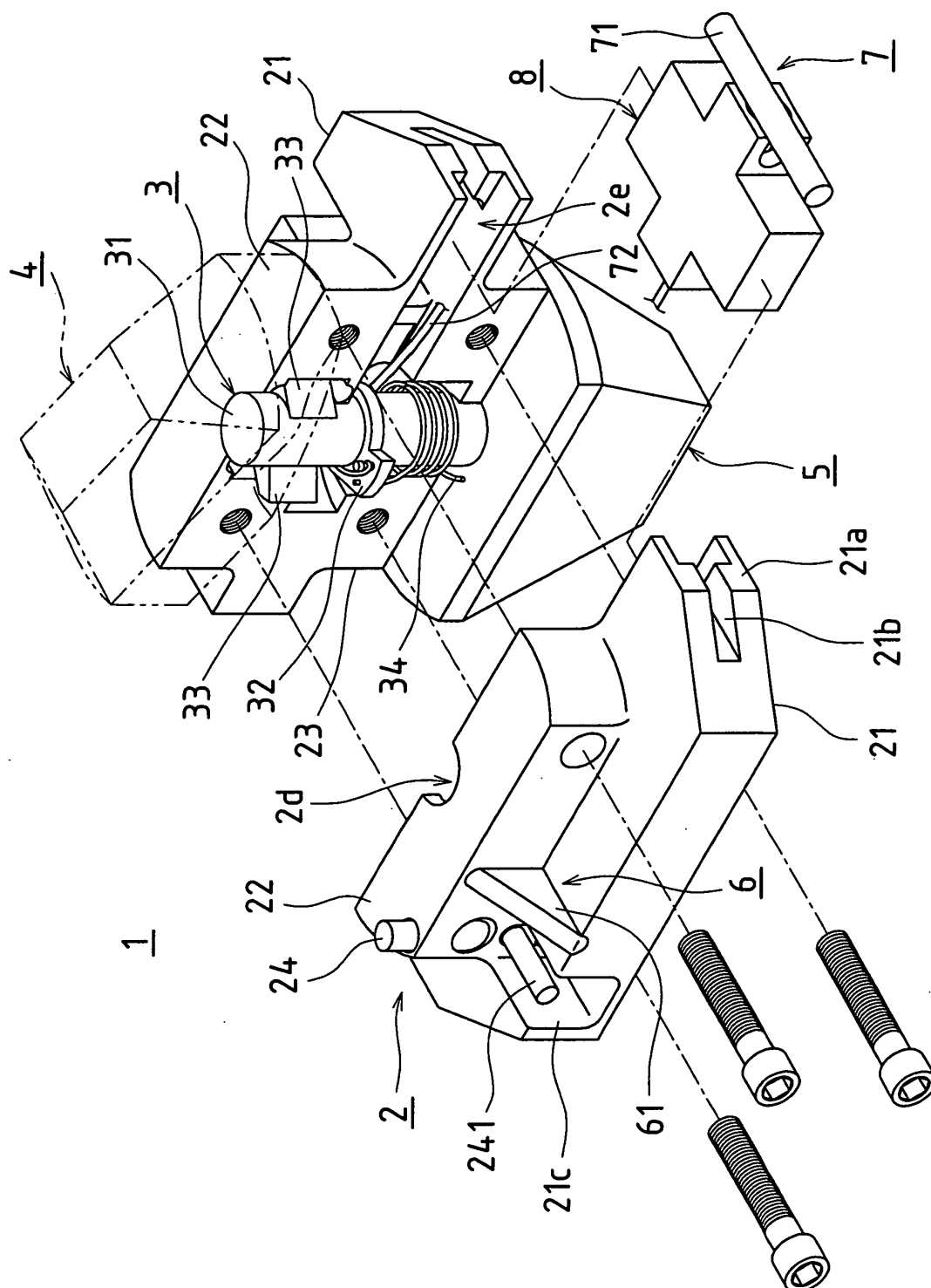


Fig.3

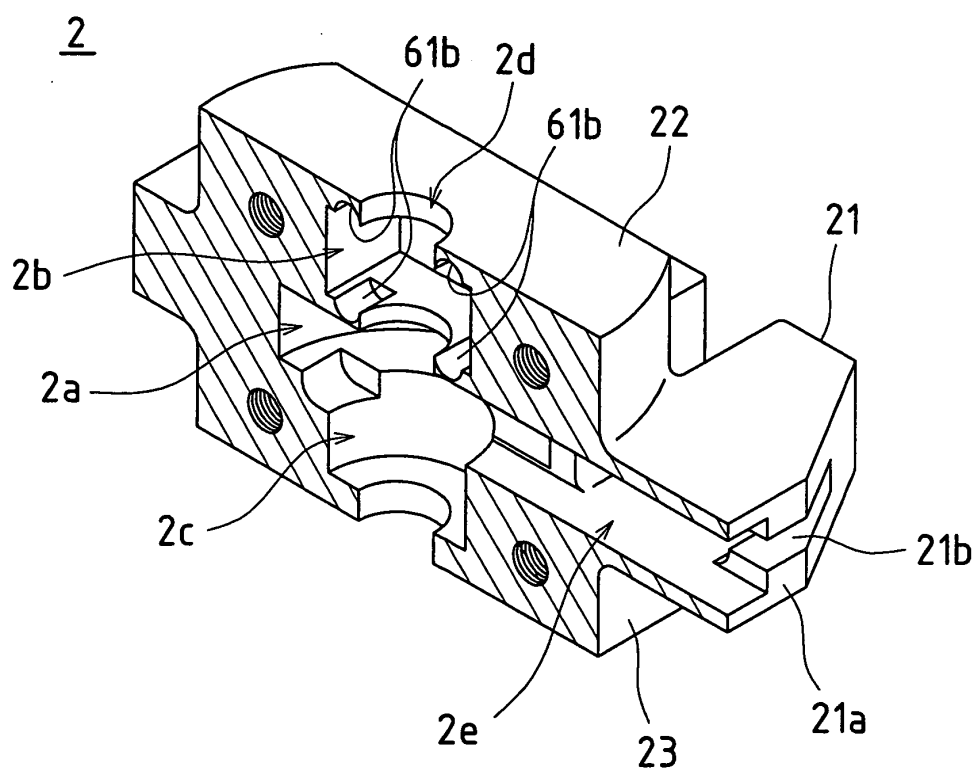


Fig.4

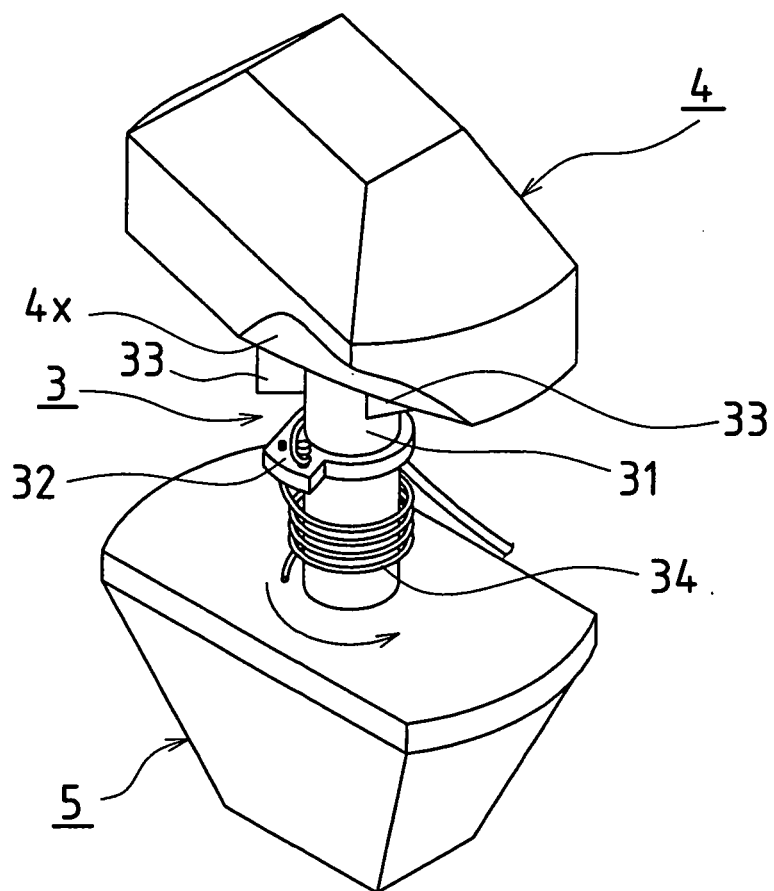


Fig.5

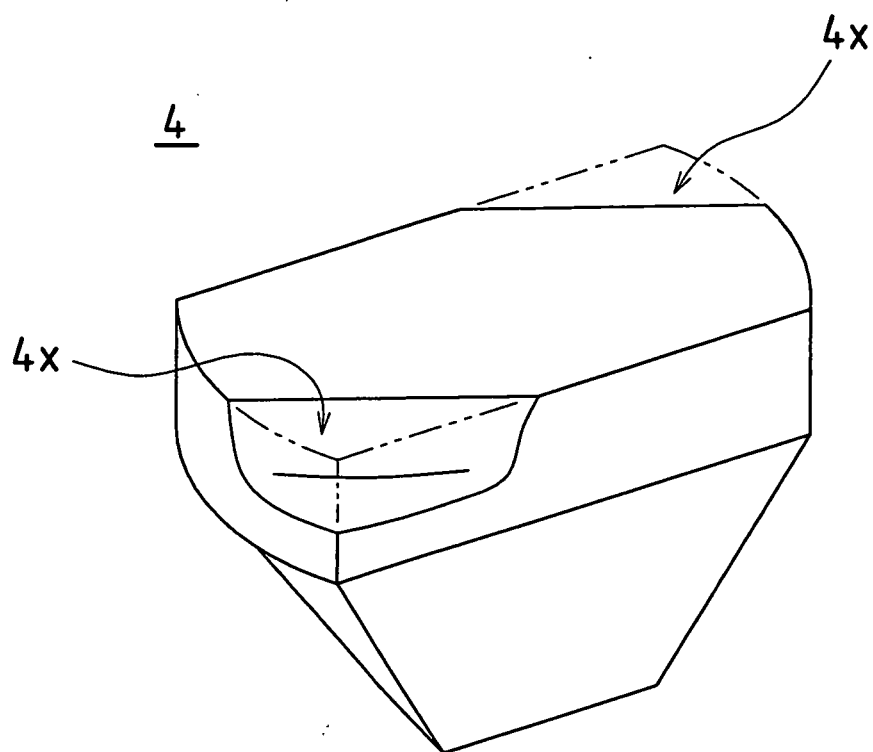


Fig.6

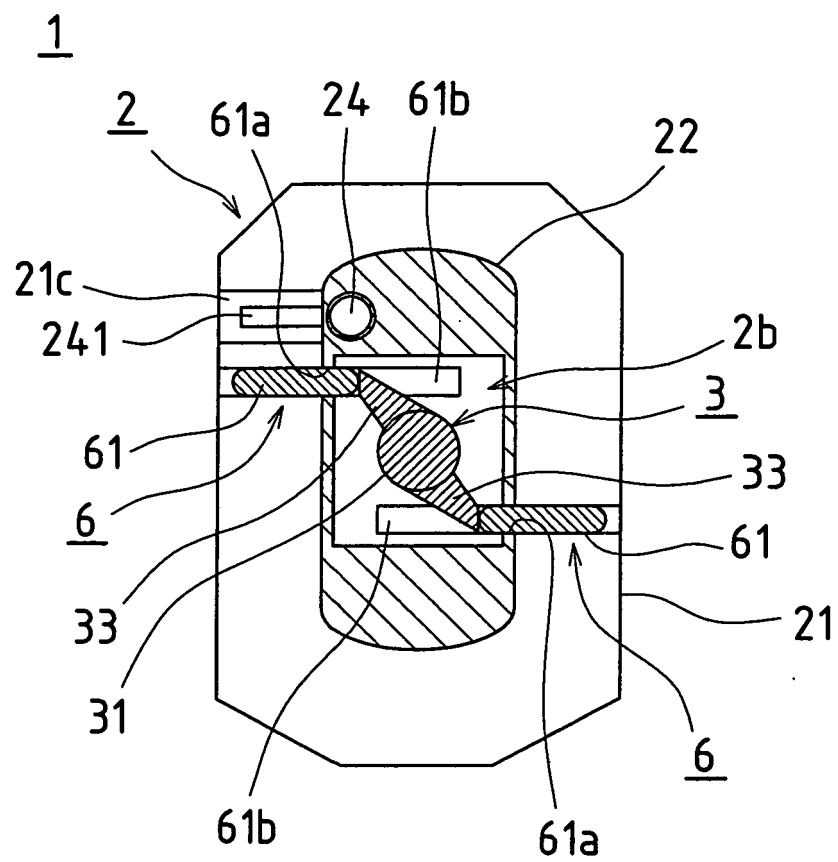


Fig.7

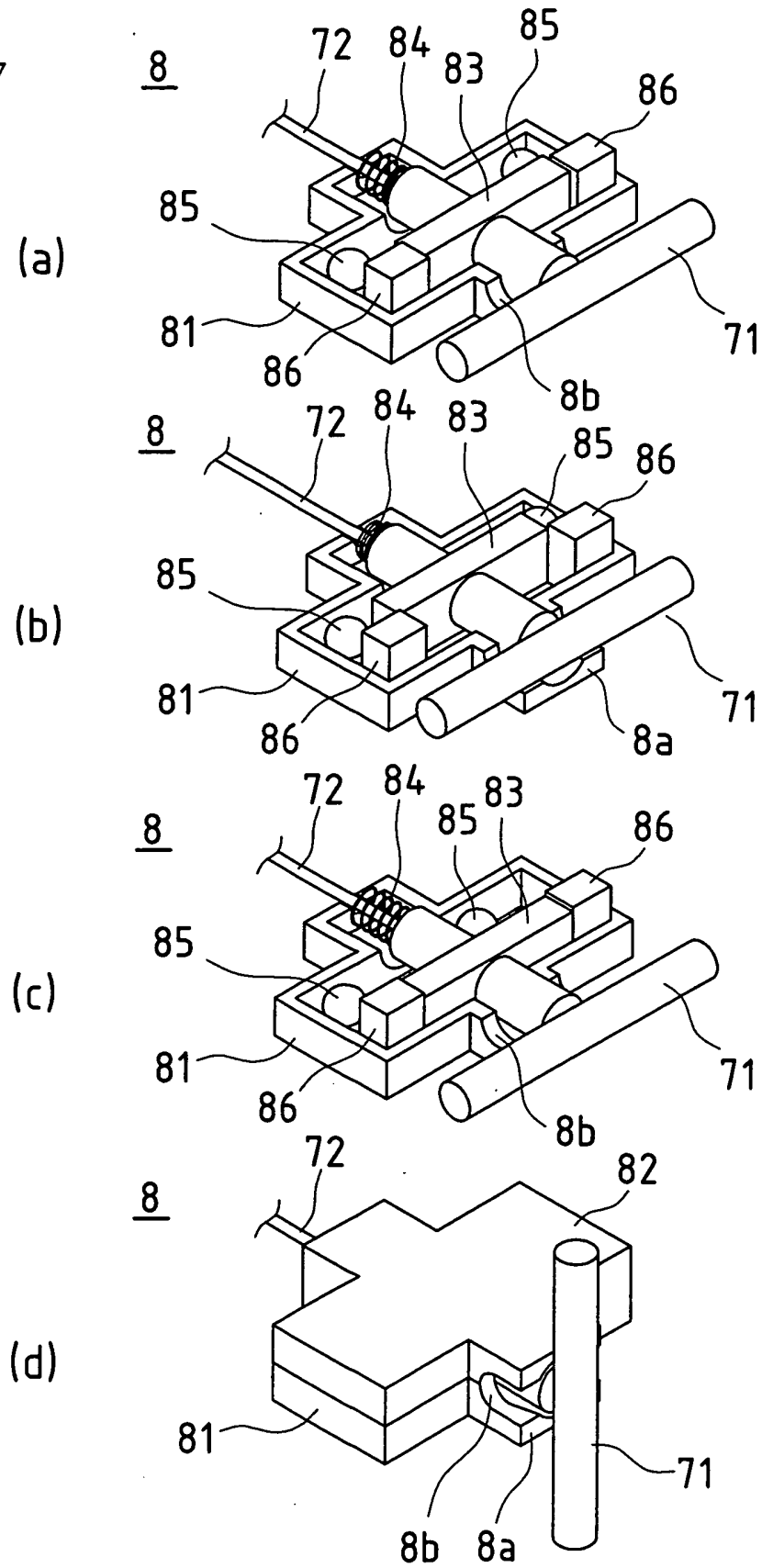


Fig.8

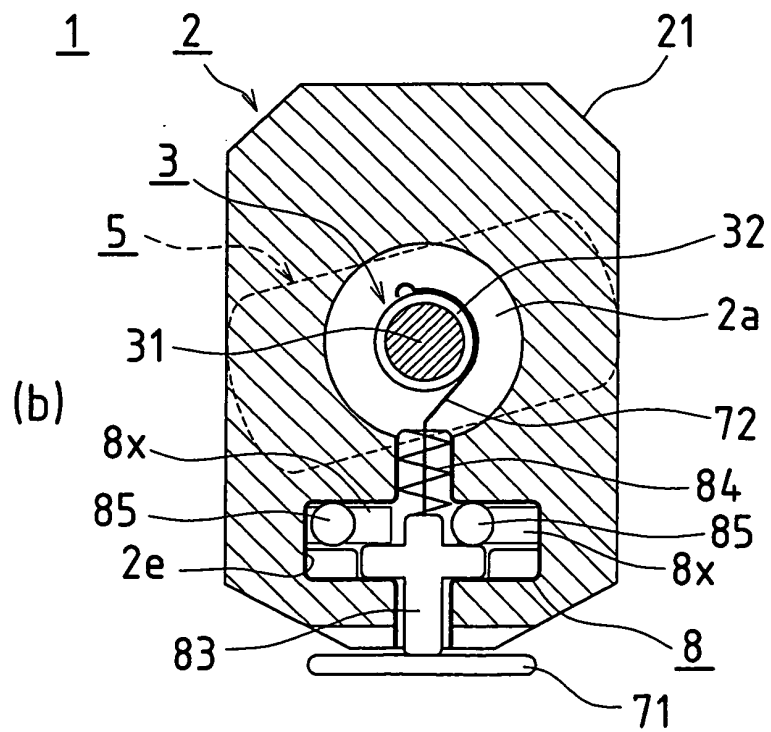
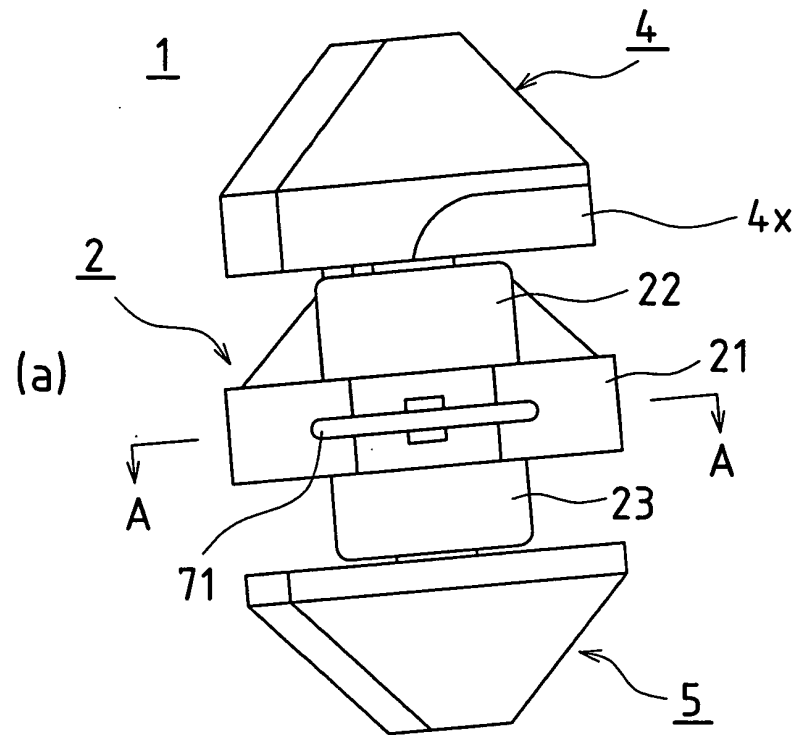


Fig.9

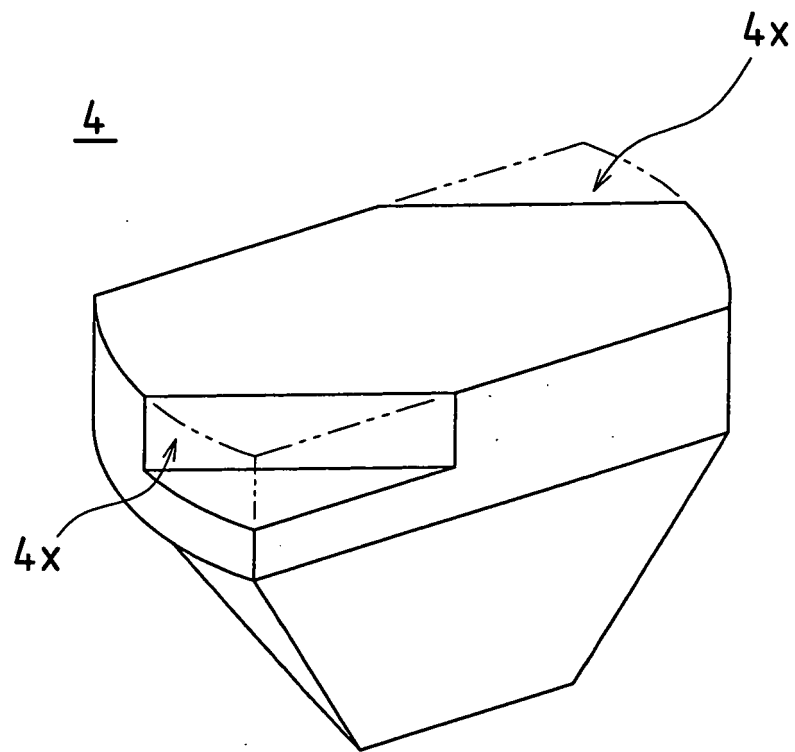


Fig.10

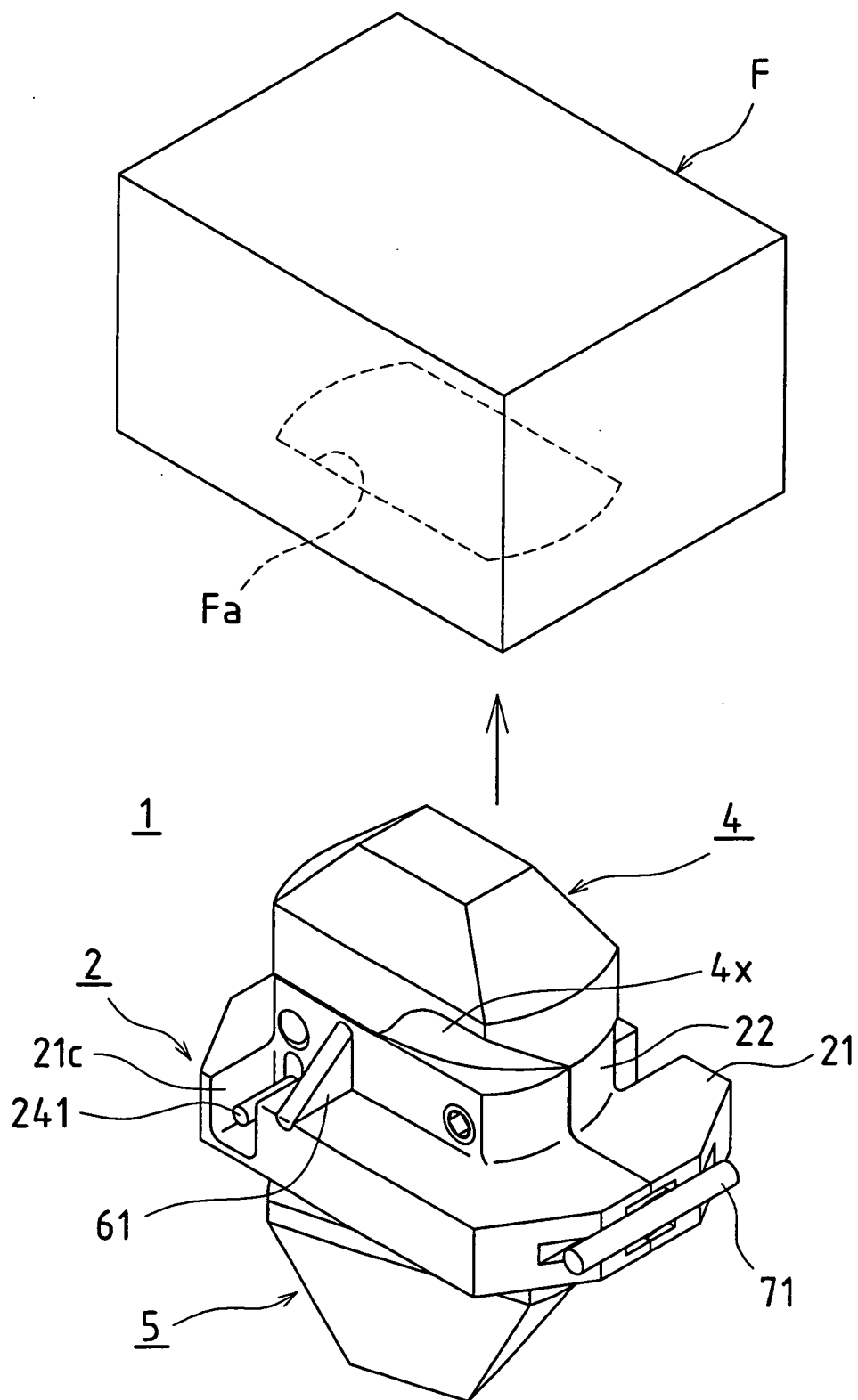


Fig.11

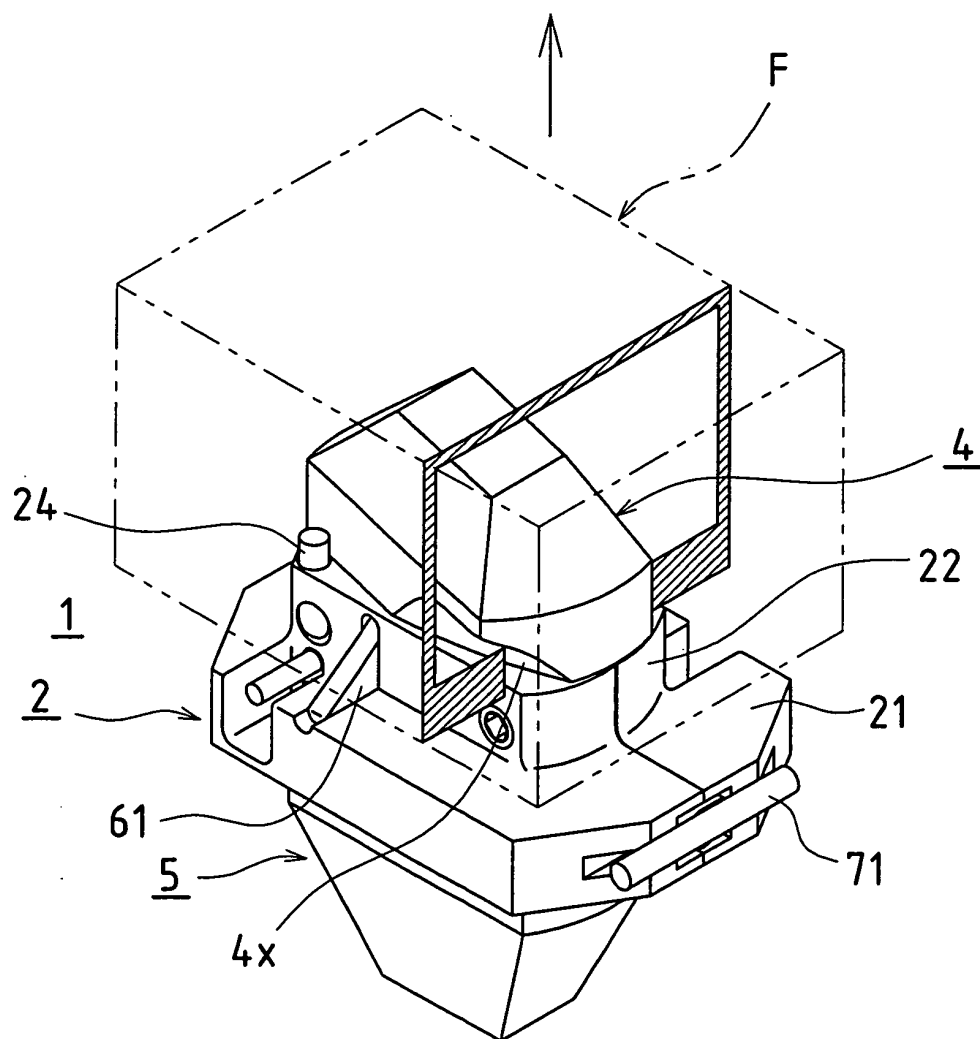


Fig.12

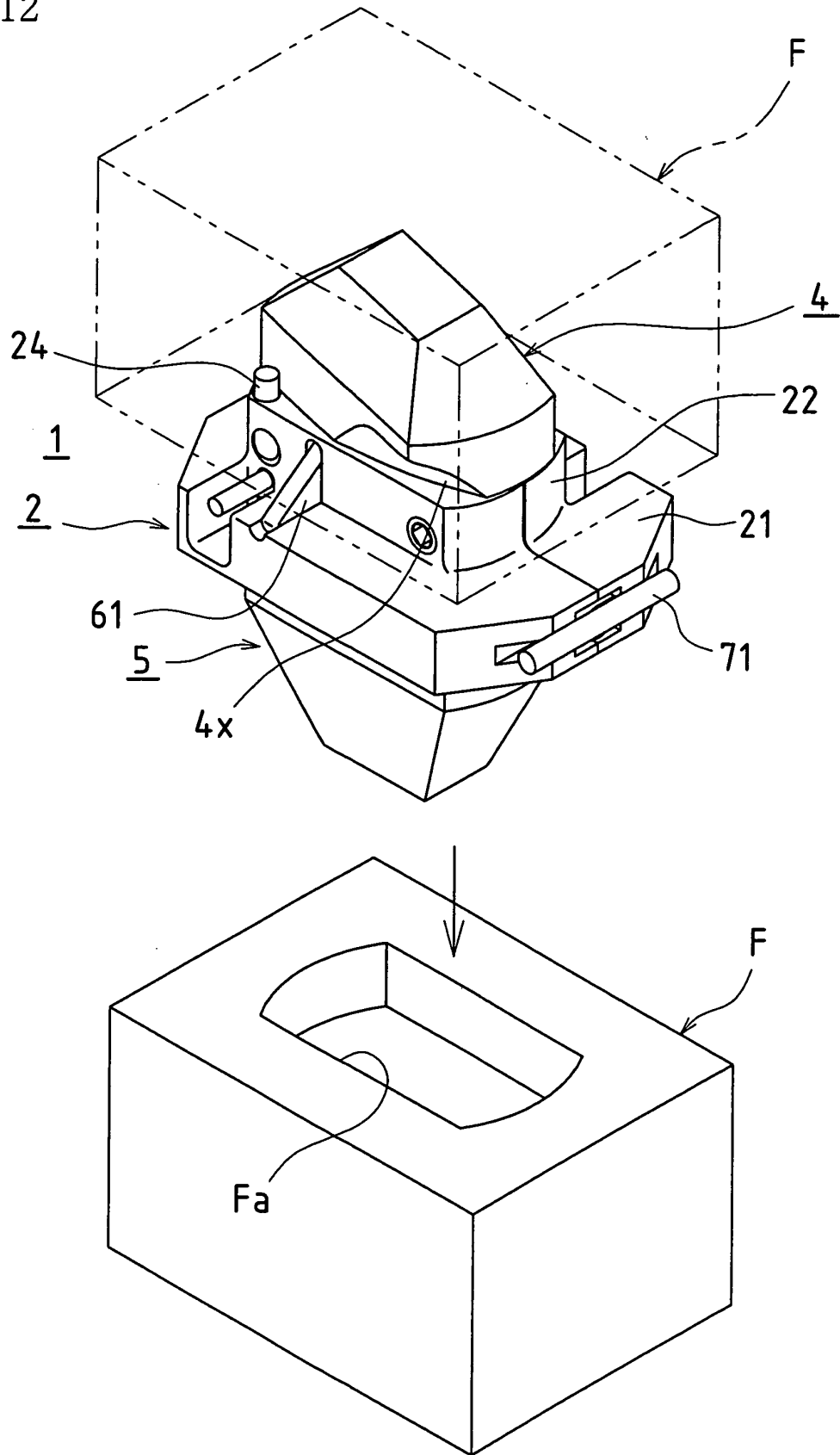


Fig.13

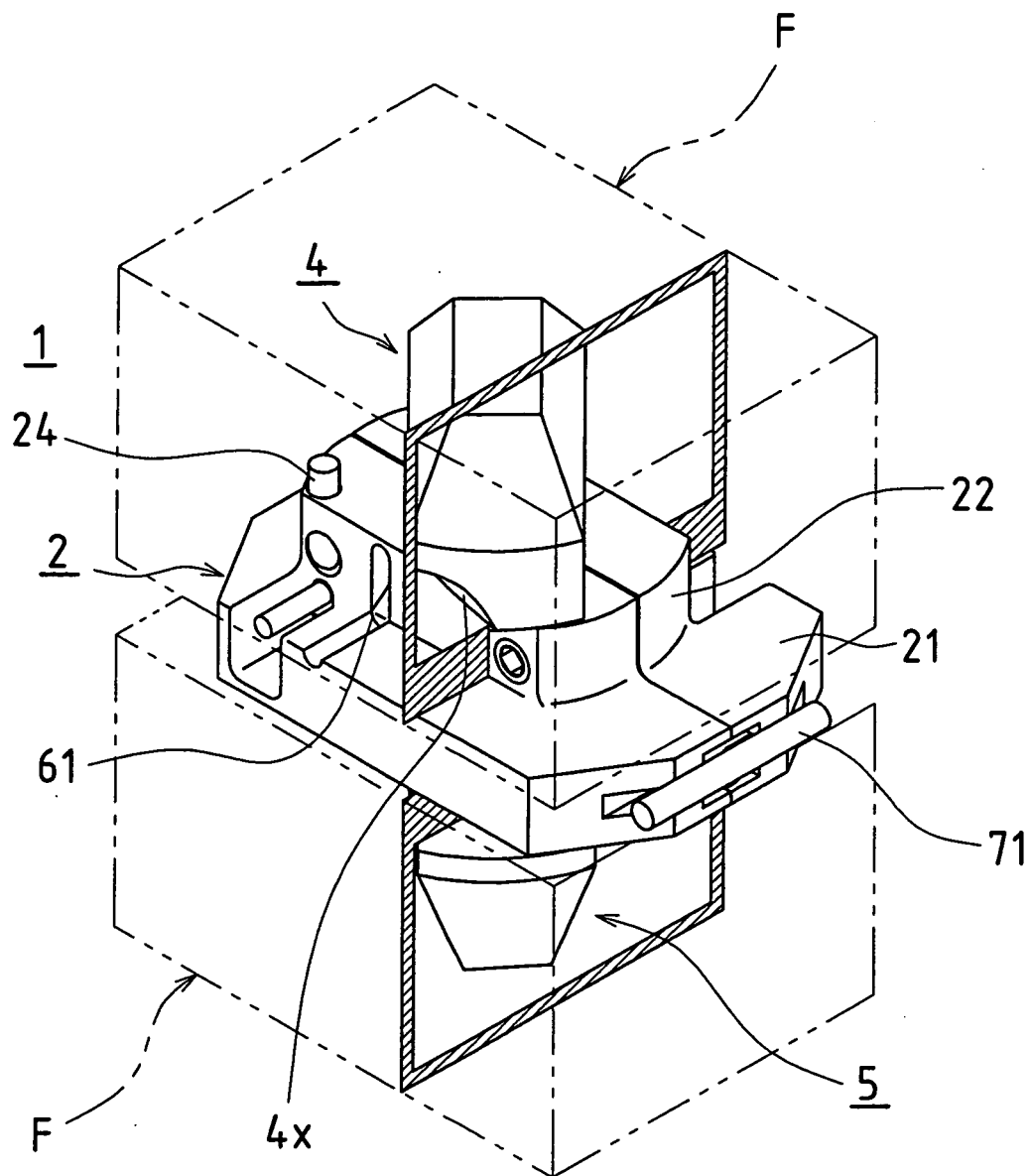


Fig.14

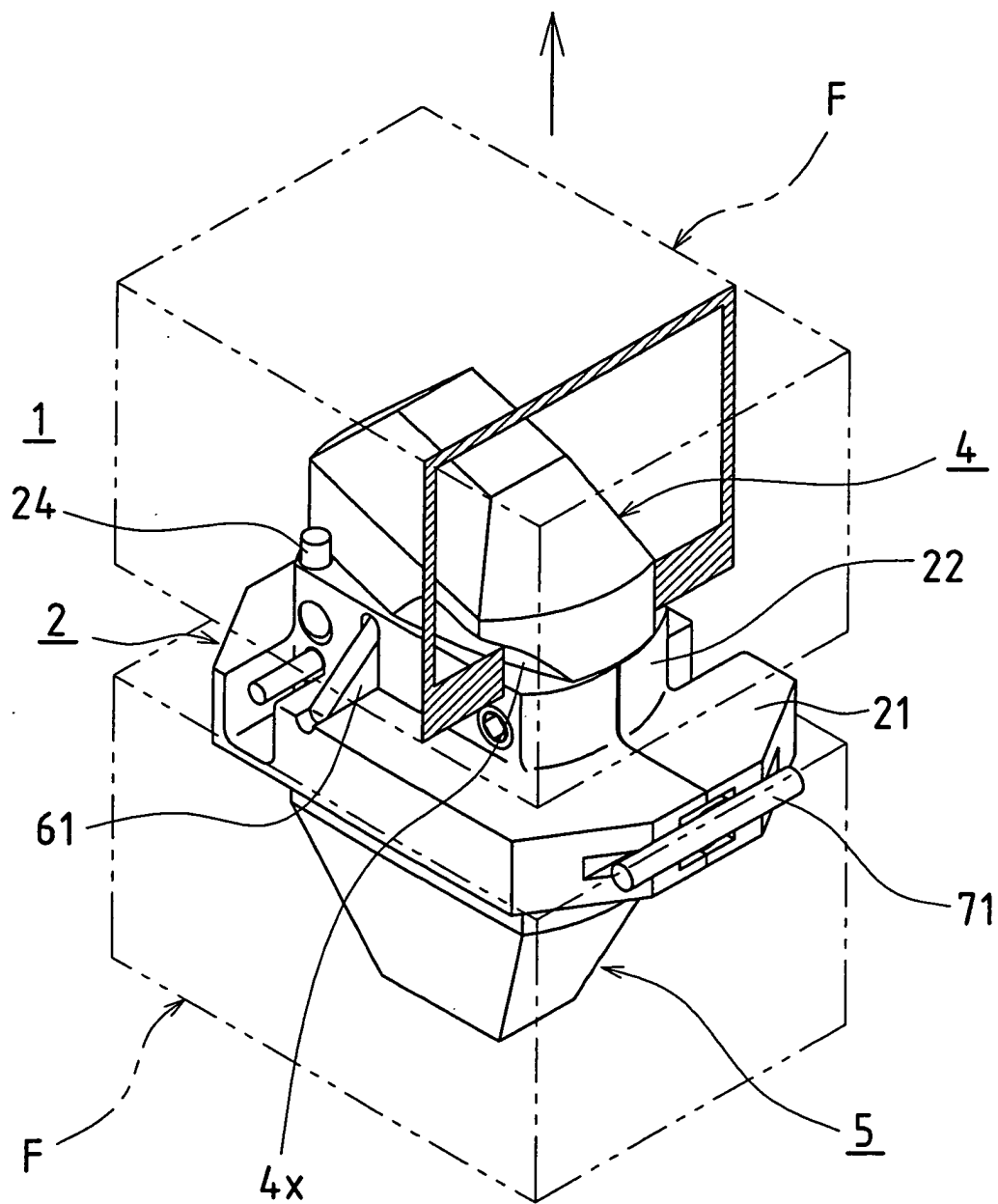


Fig.15

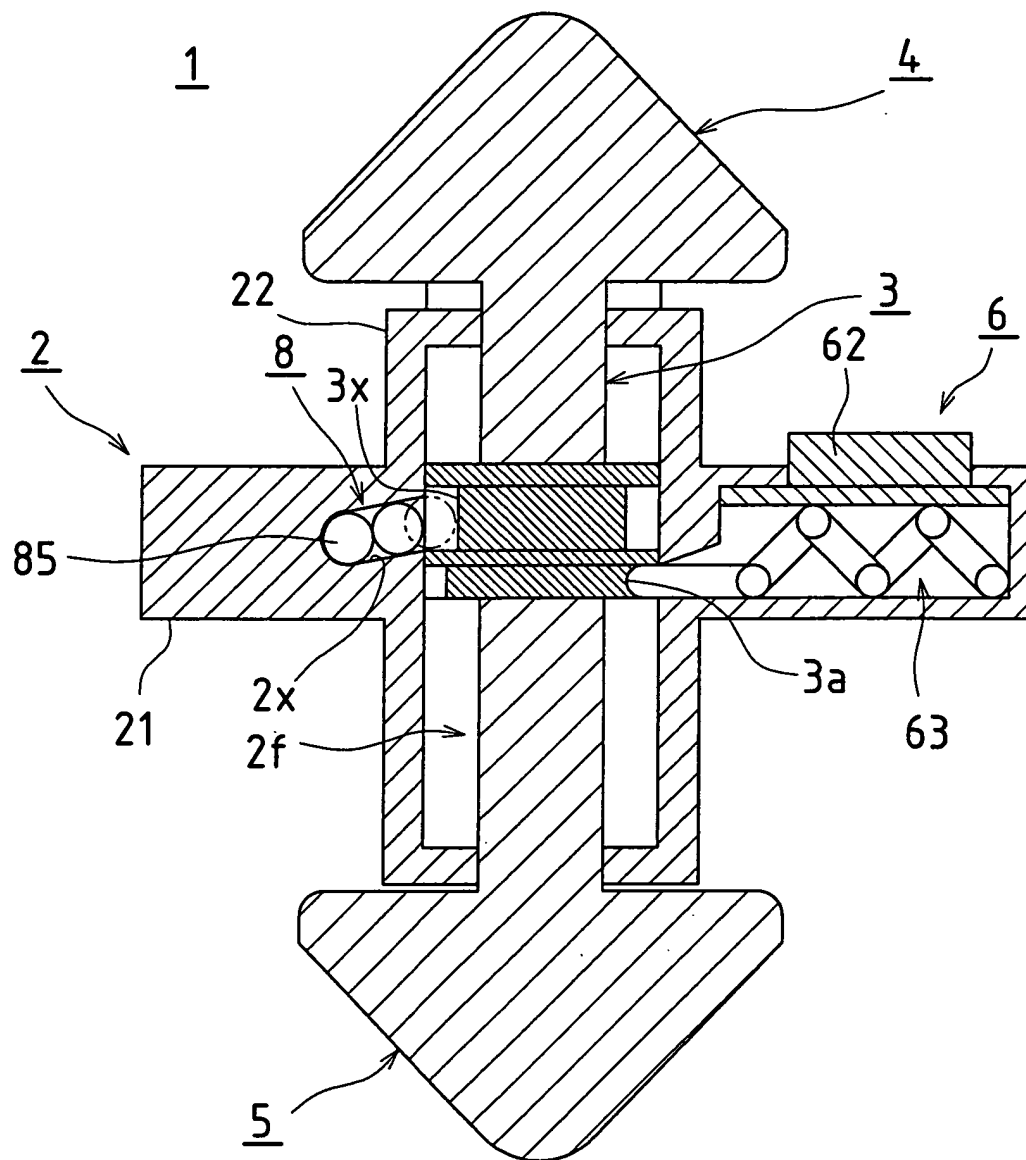


Fig.16

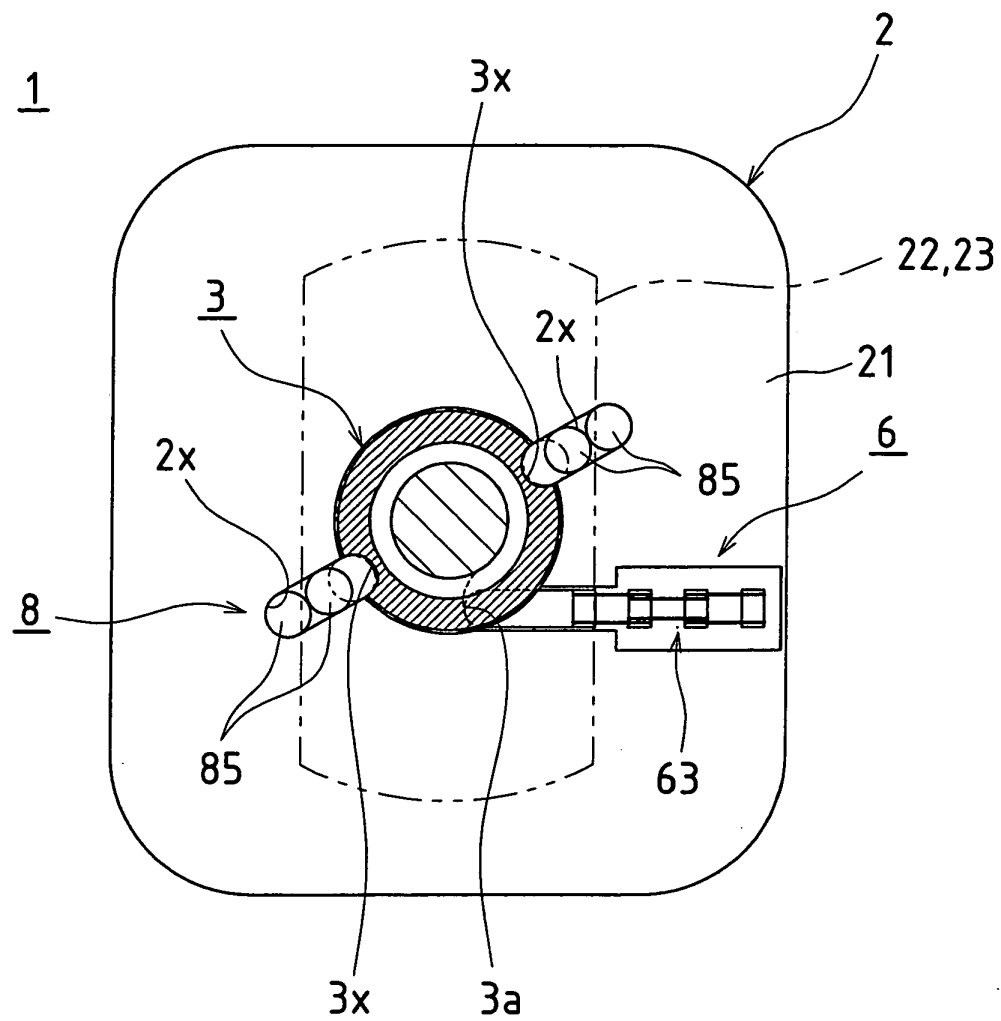


Fig.17

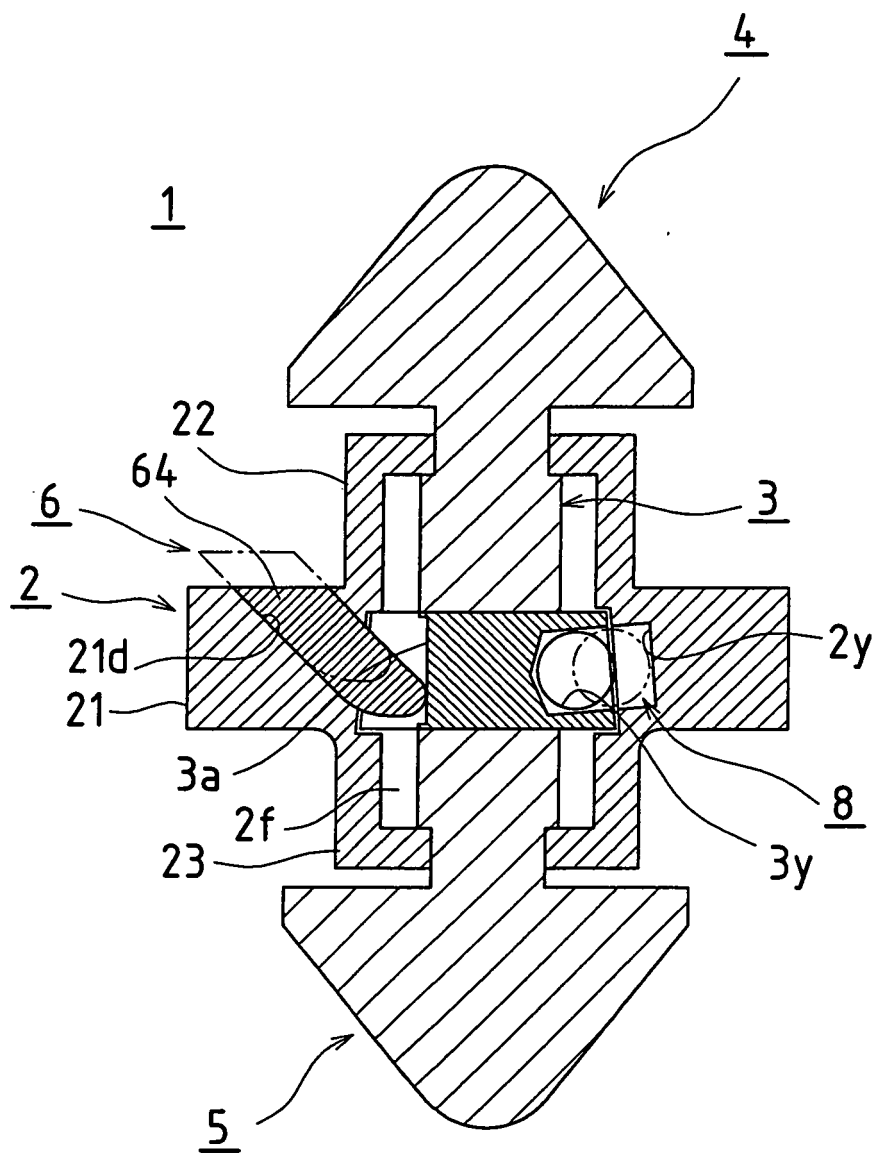


Fig.18

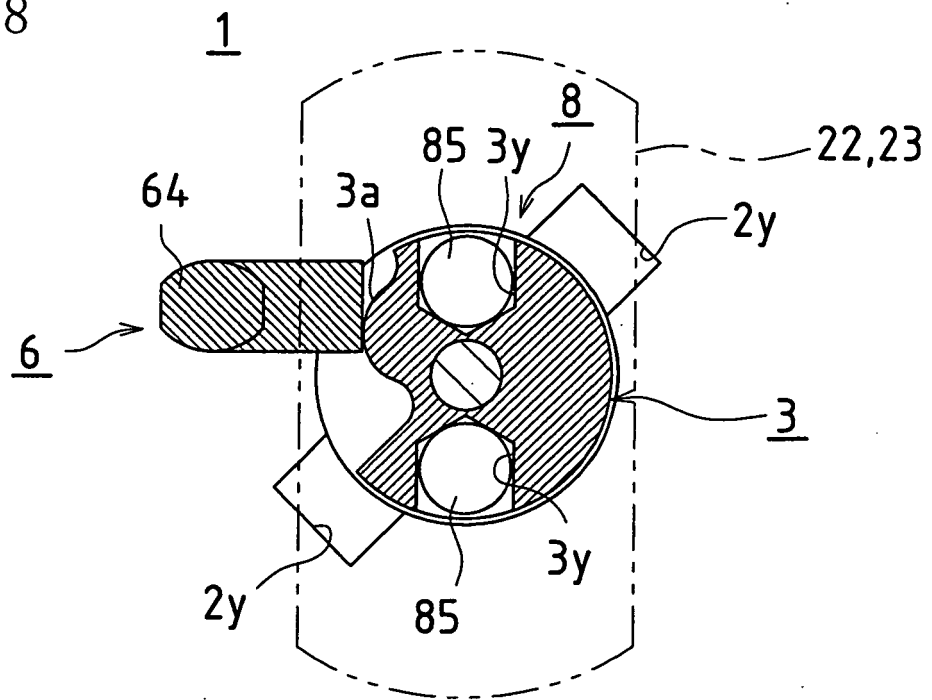


Fig.19

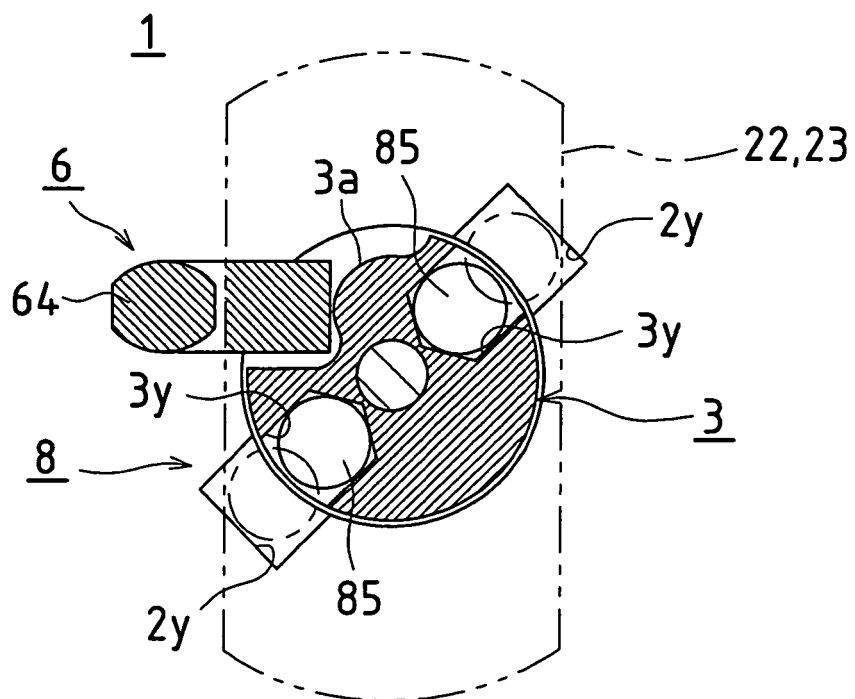


Fig.20

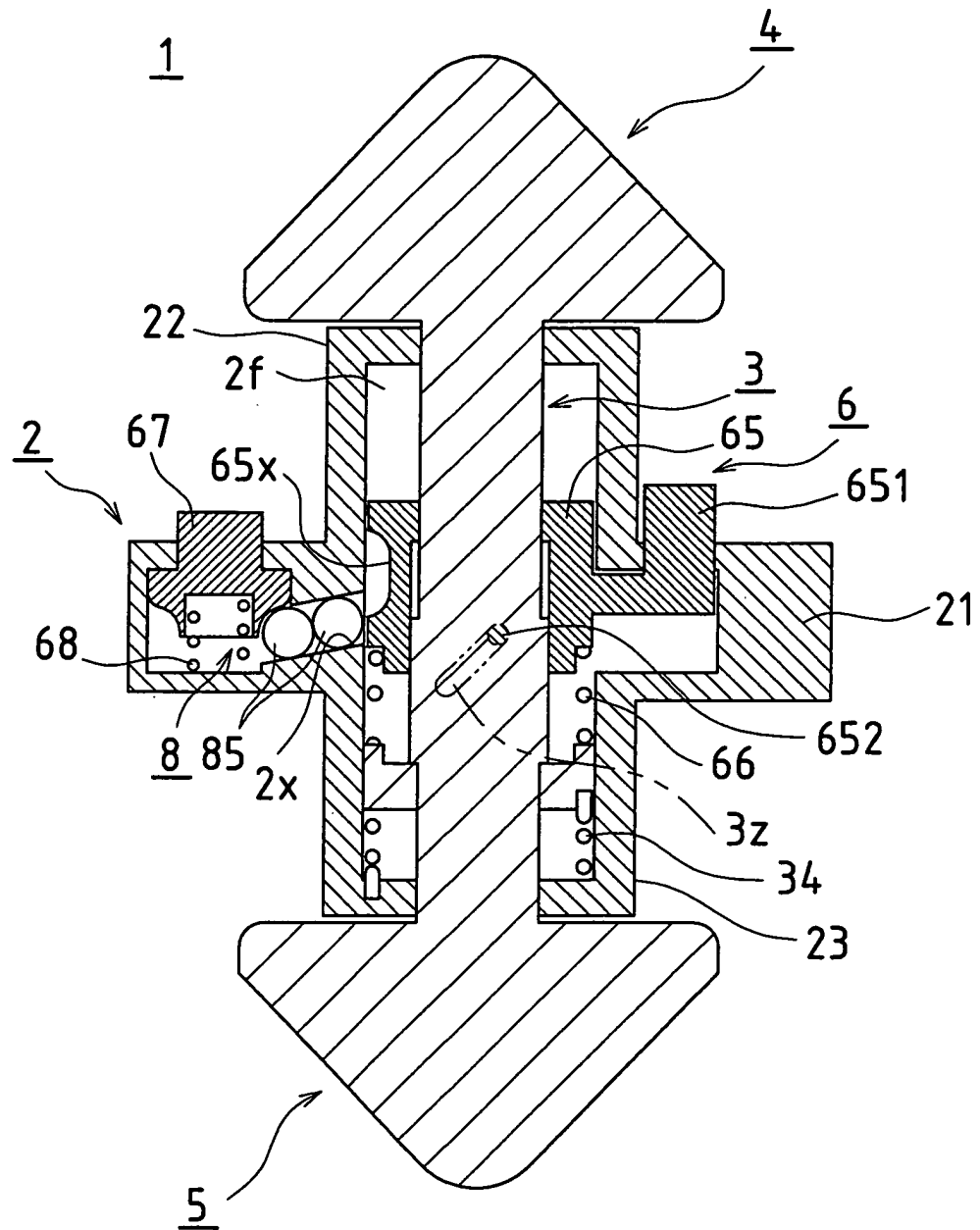


Fig.21

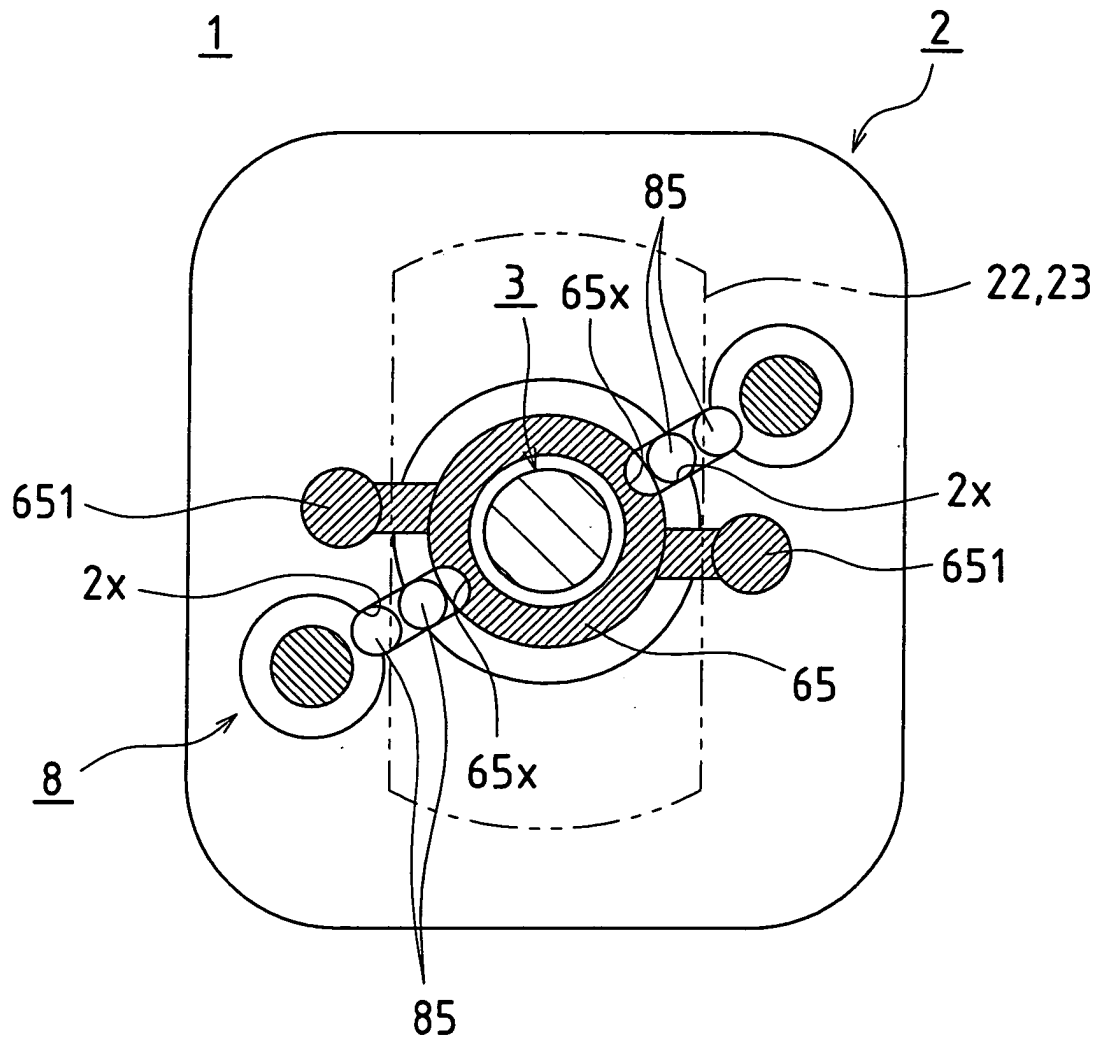


Fig.22

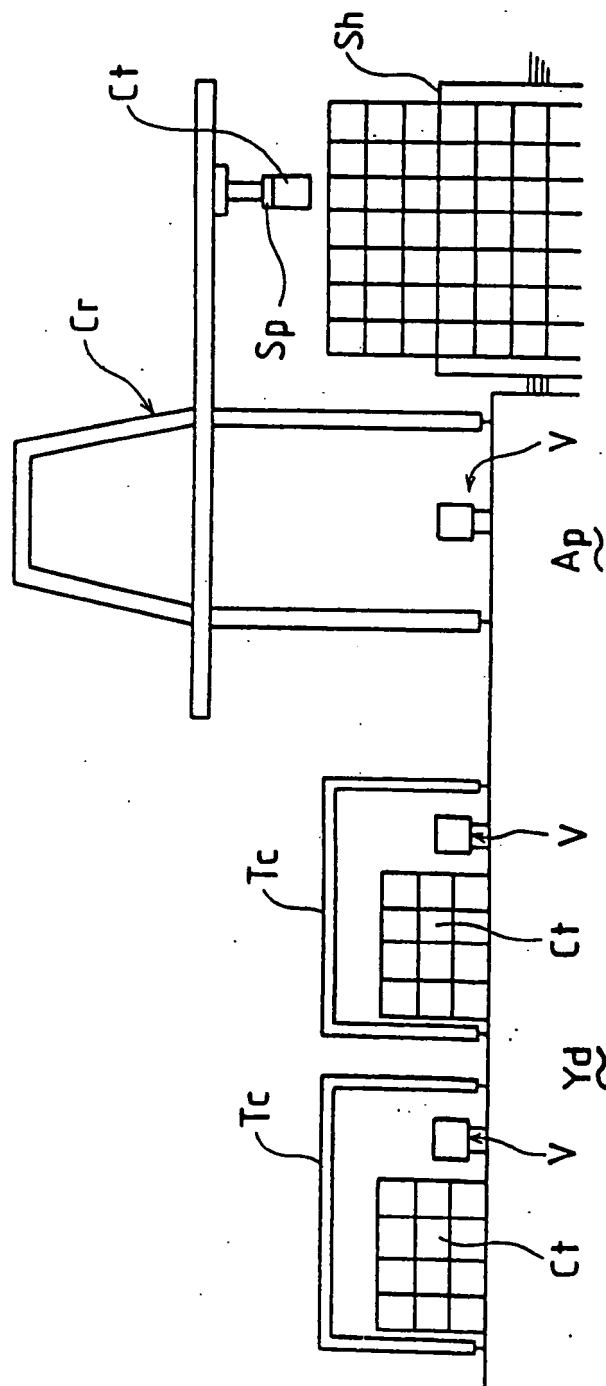


Fig.23

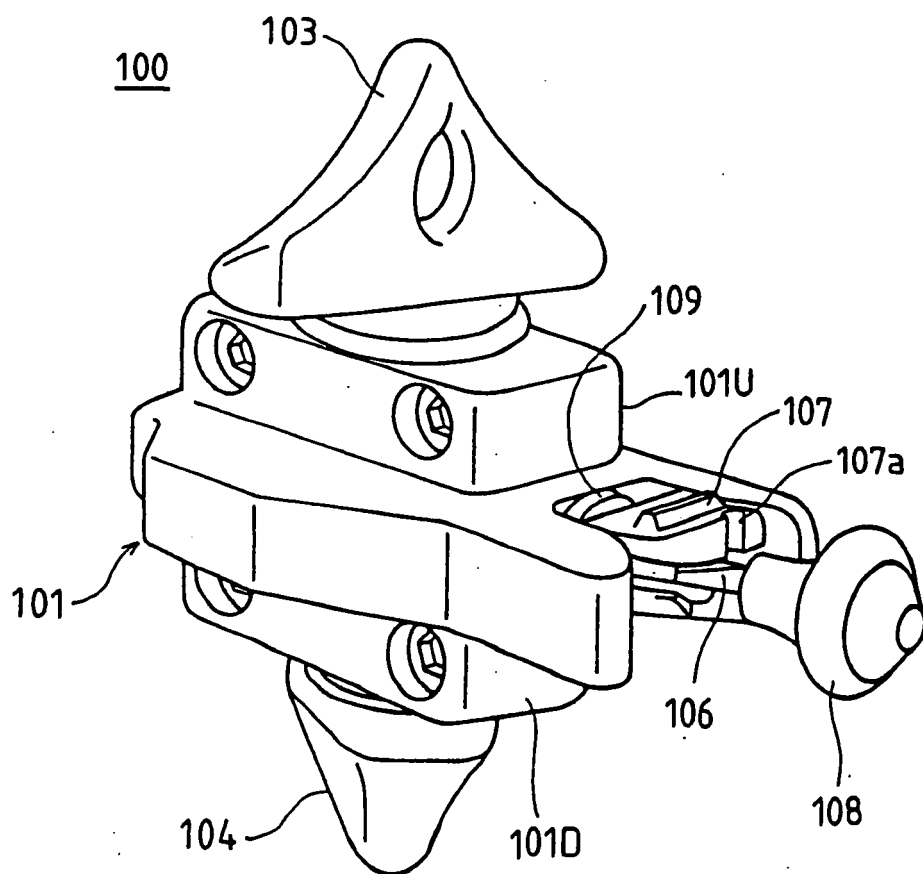


Fig.24

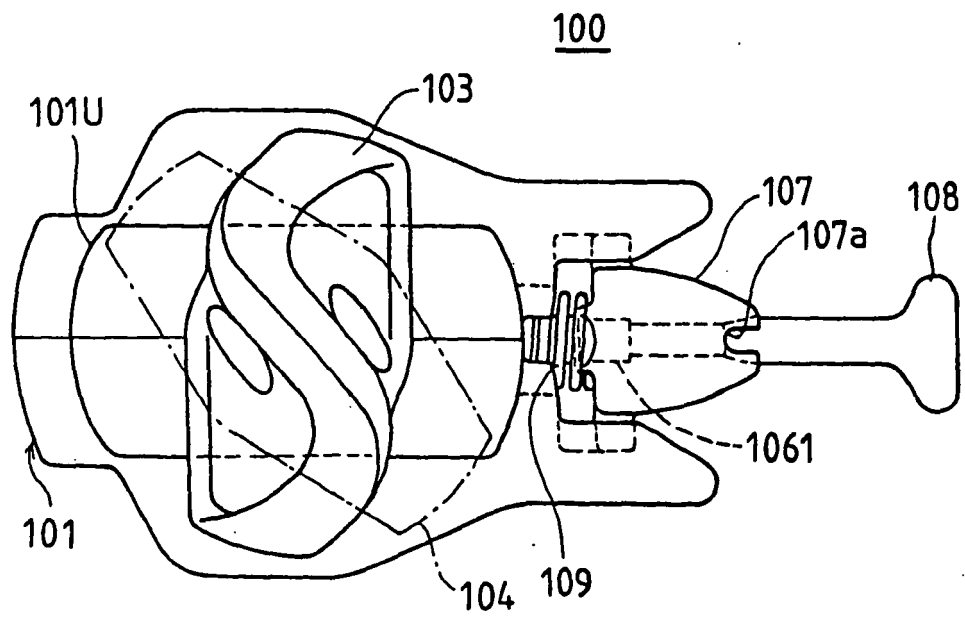


Fig.25

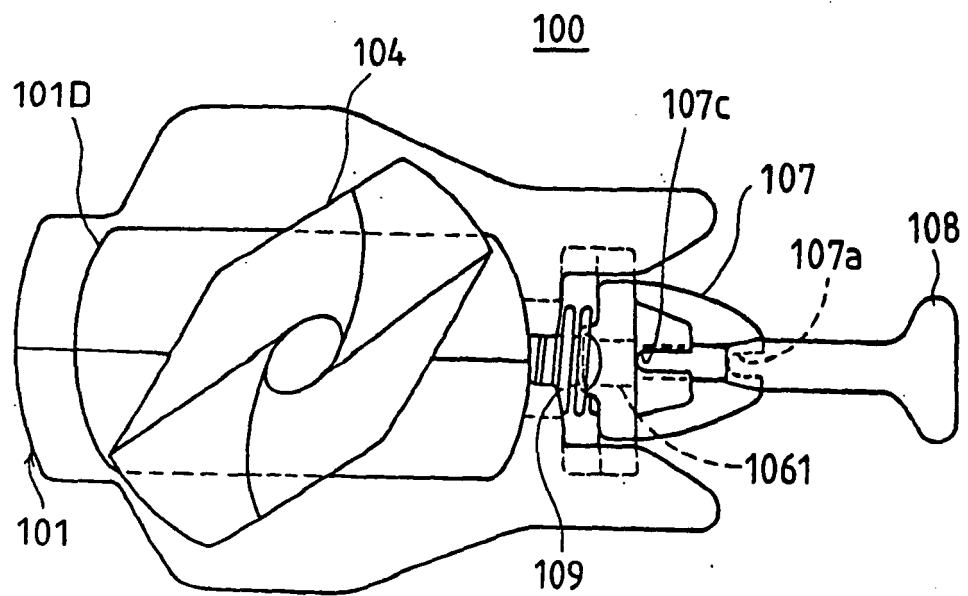


Fig.26

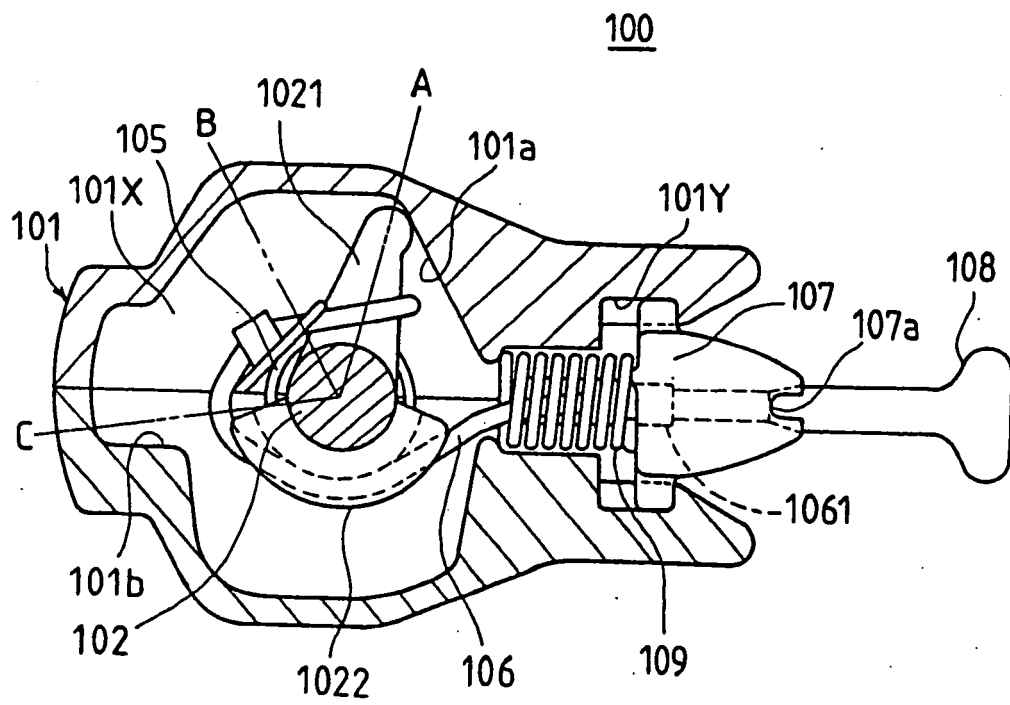


Fig.27

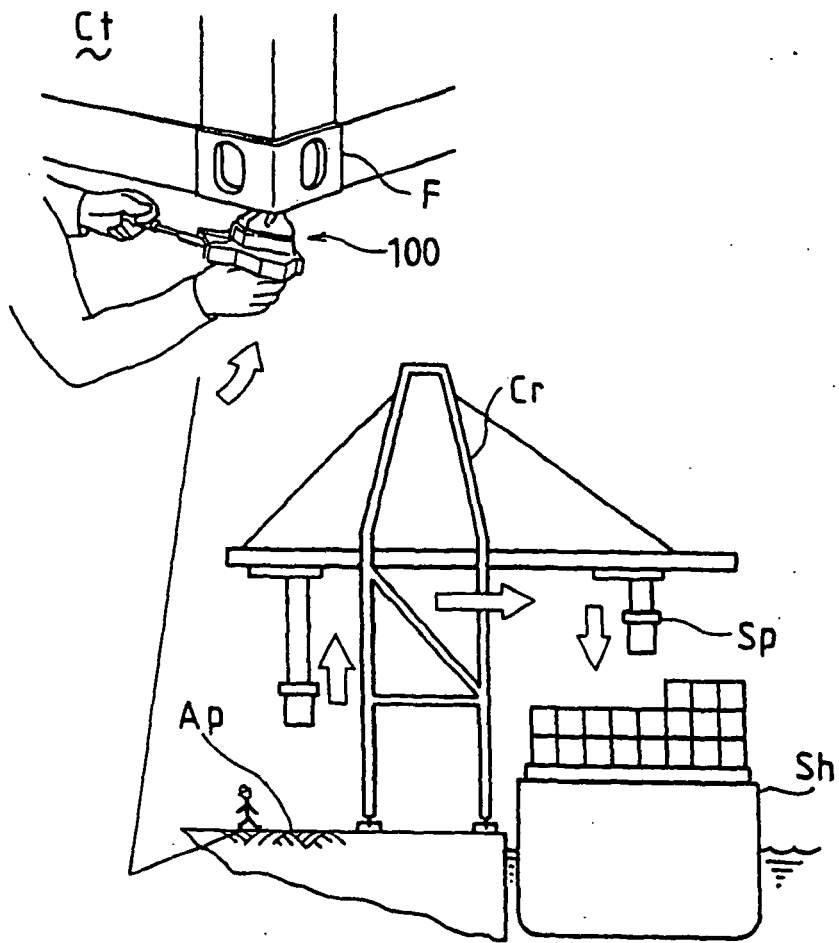


Fig.28

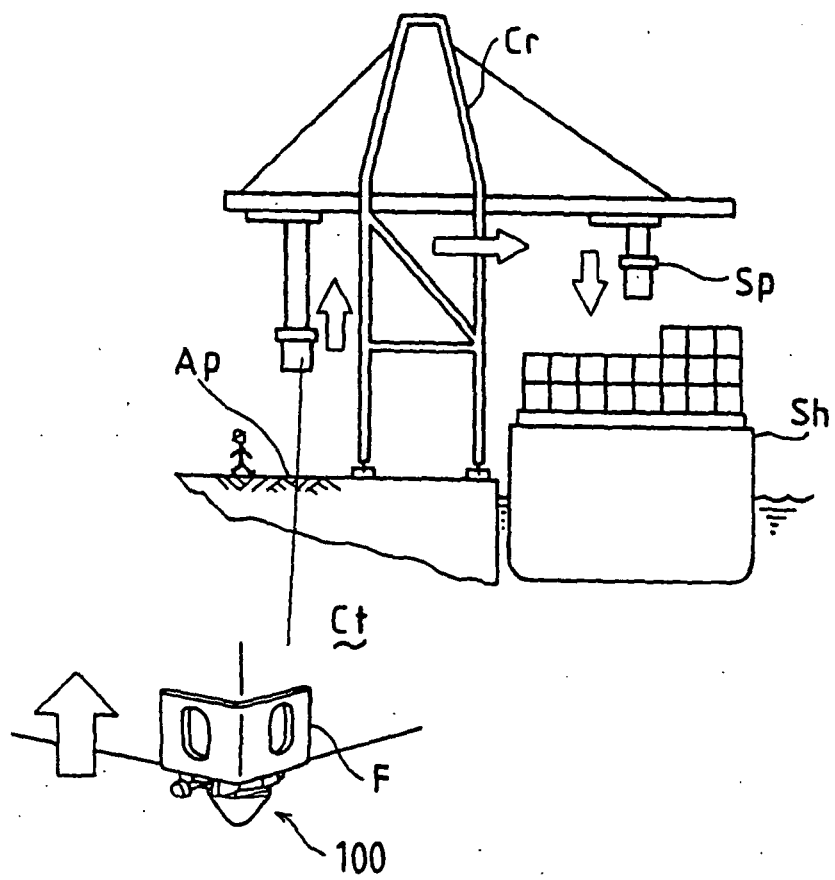


Fig.29

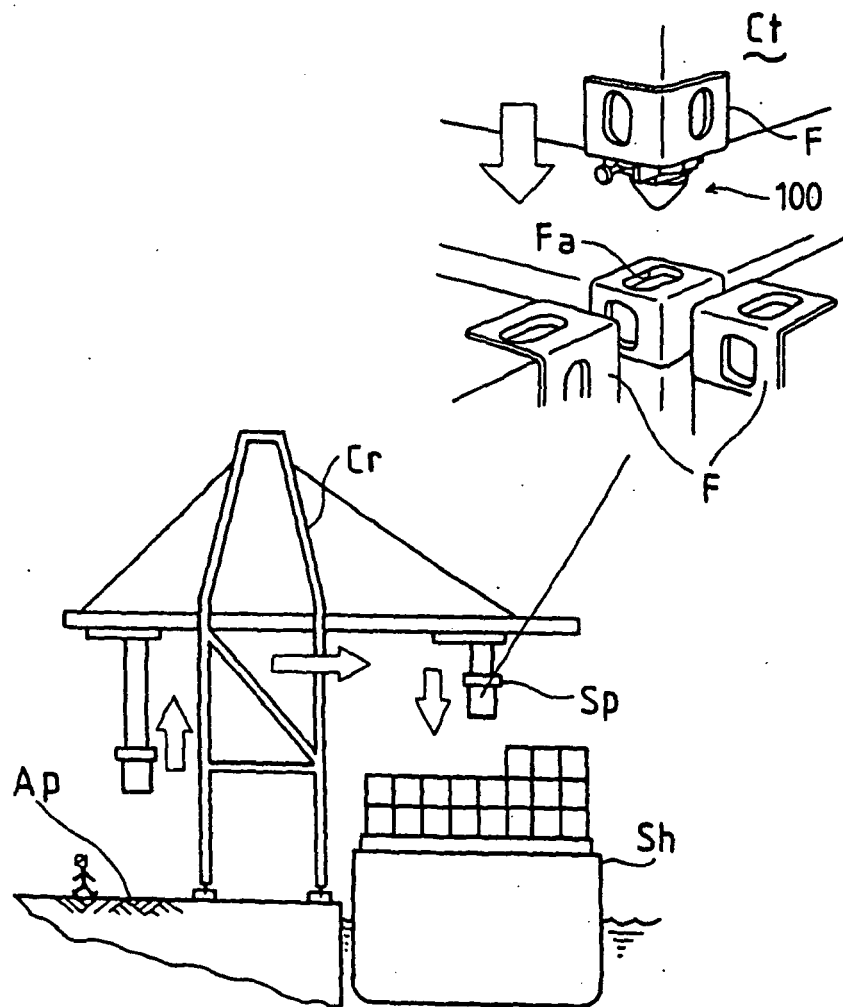


Fig.30

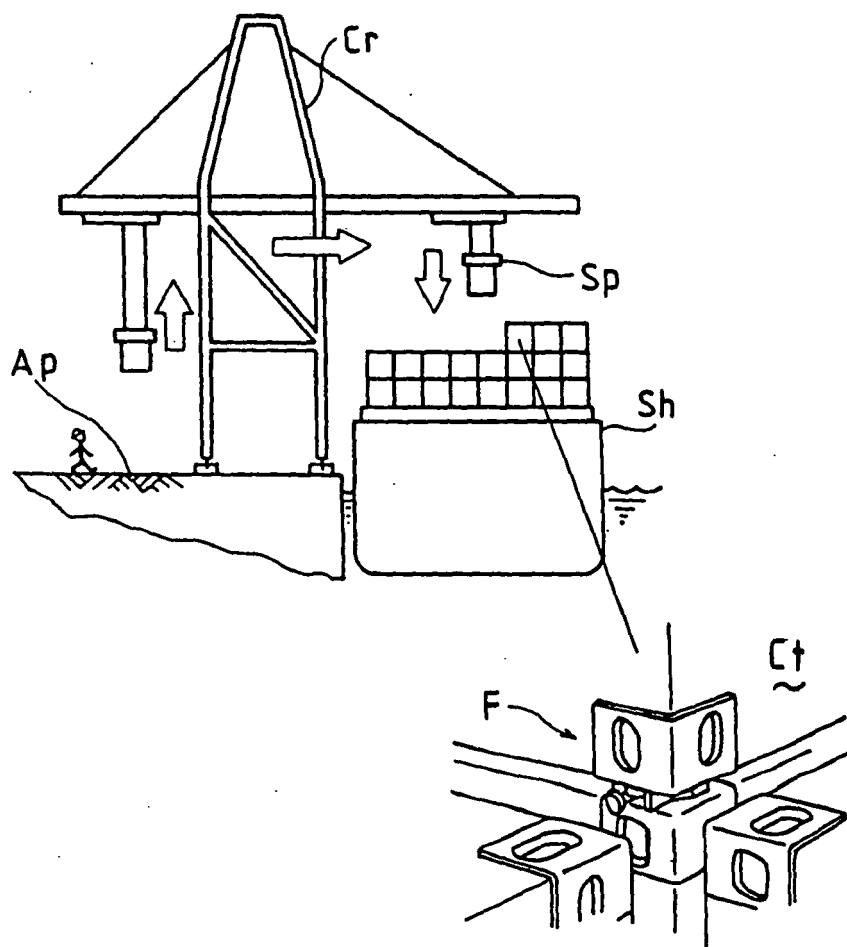


Fig.31

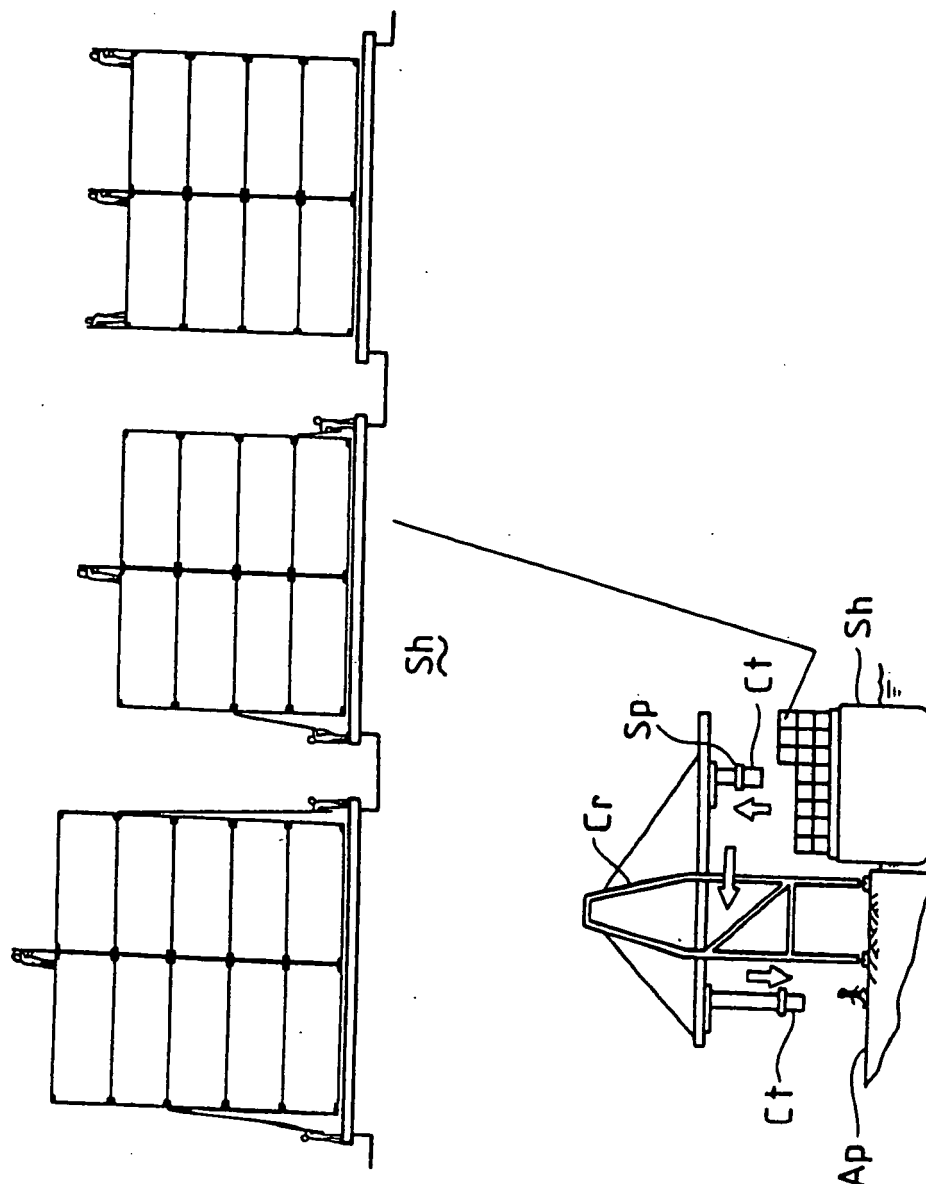
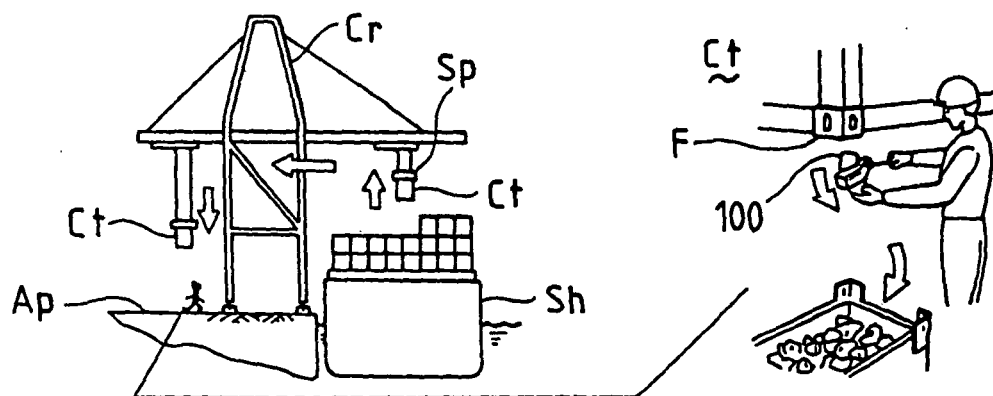


Fig.32



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/06960

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁷ B65D90/00, B63B25/00		
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) Int.Cl. ⁷ B65D88/12, 90/00, B63B25/00		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2003 Kokai Jitsuyo Shinan Koho 1971-2003 Jitsuyo Shinan Toroku Koho 1996-2003		
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 46-003586 A (AB. Batsukutemansu Patenteru), 02 November, 1971 (02.11.71), (Family: none)	1-13
A	JP 11-105617 A (Kabushiki Kaisha Marifit), 02 April, 1999 (02.04.99), (Family: none)	1-13
A	WO 89/01907 A1 (I/S AA-LYKKE), 09 March, 1989 (09.03.89), & AU 198823891 A1 & DK 171376 B	1-13
A	DE 3642399 A1 (Conver-OSR), 23 June, 1988 (23.06.88), (Family: none)	1-13
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "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) "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		"T" 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 "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 "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
Date of the actual completion of the international search 02 September, 2003 (02.09.03)		Date of mailing of the international search report 16 September, 2003 (16.09.03)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/06960

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 00/23358 A1 (Kabushiki Kaisha Marifit), 27 April, 2000 (27.04.00), & US 6336765 B1	9-13

Form PCT/ISA/210 (continuation of second sheet) (July 1998)