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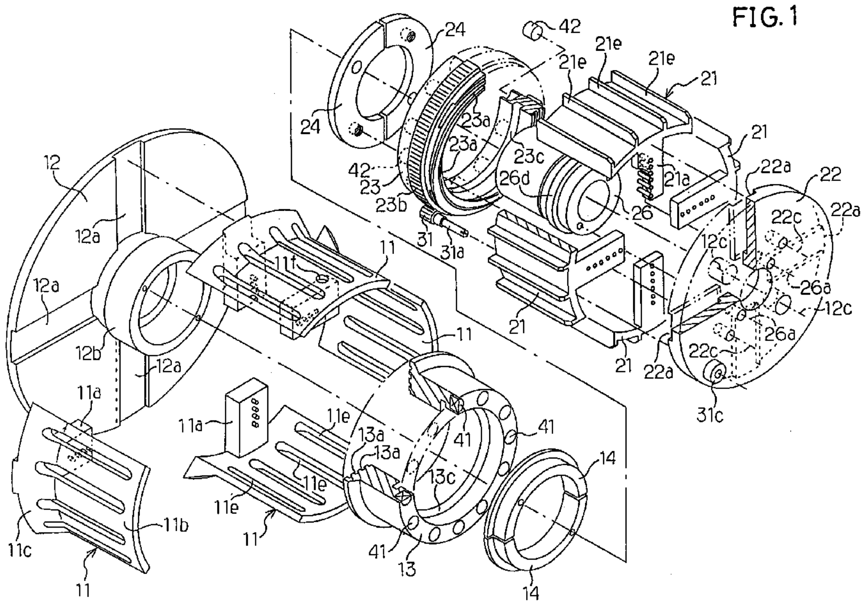
(54) **Drum diameter setting device for weft measuring and storage apparatus**

(57) A drum diameter setting device for an weft measuring and storage apparatus, the drum diameter setting device includes a plurality of measuring drum segments; a first cam for moving the plurality of measuring drum segments simultaneously in a radial direction and locking the same; a plurality of feed drum segments; a second cam for moving the plurality of feed drum segments simultaneously and locking the same; a driver for rotating one of the first cam and the second cam; and an interlocking member for interlocking the first cam and the second cam.

FIG. 1



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Description

Background of the Invention:

[0001] This invention relates to a drum diameter setting device used for an weft measuring and storing apparatus that enables a prompt and accurate setting of the drum diameter that is to define the weft measuring length.

[0002] Conventionally, there has been known a stationary drum type weft length measuring and storing apparatus shown in Laid Open Japanese Patent Application Serial No. 7-133552, in which an weft feed mechanism is included to arrange weft to be wound around the drum at a constant pitch.

[0003] The drum disclosed in the above document includes a plurality of measuring drum segments arranged to form a cylinder and a plurality of feed drum segments having a feed wing that are driven via an eccentric and inclined shaft. Each measuring drum segment is fixed at a certain radial position by a screw onto a drum segment holder and each feed drum segment is fixed onto another drum segment holder mounted on the eccentrically inclined shaft. When the weft length measuring amount needs to be set, each measuring drum segment is adjusted and fixed at a certain position along the radial direction and thereafter, each feed drum segment is positioned and fixed according to the fixed position of each measuring drum segment to set a drum diameter, thereby setting the weft length measuring amount. Further, each feed drum segment drives its feed wing via the eccentrically inclined shaft to project from the weft wind surface of the measuring drum segment and tilt the feed wing to the side of control pin thereby moving weft forward on the measuring drum segment. Subsequently, the each feed drum segment drives its feed wing sink from the weft wind surface of the measuring drum segment in the radial direction thereof and tilt the feed wing to the side of a rotational yarn guide to move back to its original position, thereby weft wound around the drum is fed forward at a certain weft pitch to achieve a well-arranged winding posture on the drum, easing the rewindability of weft from the wound weft on the drum.

[0004] In the above described apparatus, when the drum diameter needs to be adjusted, each of the measuring drum segments and each of the feed drum segments need to be individually positioned and fixed, thus making the drum diameter set operation enormously time consuming task. Furthermore, some dispersion, if occurs, in fixed positions among the measuring segments or in the feed drum segments likely disable to obtain the desired measuring amount or weft pitch, causing reworks in adjustment of the measuring drum segments and the feed drum segments. In addition, each feed drum needs to be positioned at a proper position with respect to its corresponding measuring drum segment; however, if it fails to keep a proper positional relationships between the measuring drum segment and the feed drum segment, it affects a weft feed amount that in turn changes the weft pitch, causing the fluff of the neighboring weft to trap in the irregular pitched portion of the wound weft . As a result, it may raise a resistance force for the weft to be rewind from the wound weft on the drum.

[0005] Thus, there is room for improvement in enabling the drum diameter set operation easier without sacrificing the precision.

Summary of the Invention:

[0006] It is an object of this invention to provide an weft diameter setting device that solves the problems of the prior art apparatus as described in the above section.

[0007] It is another object of this invention to provide an weft diameter setting device to include an interlocking member for interlocking a first cam for driving a measuring drum segment and a second cam for driving a feed drum segment to enable easy and simple drum diameter setting operation without sacrificing the precision.

[0008] In order to fulfill the above objects, an weft diameter setting device according to this invention comprises a plurality of measuring drum segments; a first cam for moving the plurality of measuring drum segments simultaneously in a radial direction and locking the same; a plurality of feed drum segments; a second cam for moving the plurality of feed drum segments simultaneously and locking the same; a driver for rotating one of the first cam and the second cam; and an interlocking member for interlocking the first cam and the second cam.

[0009] With the aforementioned device, when setting drum diameter, the interlocking member interlocks the first cam and the second cam thereby simultaneously moves all the measuring drum segments and the feed drum segments in the radial direction in response to the rotation of either one of the first cam or the second cam by operation of the driver, securely maintaining the relative positions among the measuring drum segments and the relative position between each measuring drum segment and corresponding feed drum segment. As a result, each measuring drum segment sets a certain measuring length and each feed drum segment produces a weft feed motion to realize a certain weft pitch.

[0010] In the above described device, each of the measuring drum segments may have an engaging pin that is engaged in a spiral groove formed on the first cam and each of the feed drum segments may have an engaging pin that is engaged in a spiral groove formed on the second cam.

[0011] With the aforementioned arrangement, the first cam and the second cam respectively move the measuring drum segments and the feed drum segments simultaneously in accordance with "lead(s)", the displacement amounts in the radial direction, defined by the rotations (angular displacements) of the spiral grooves formed on each of the first cam and the second cam in response to the rotation thereof. Thus dispersion of the movements among measuring drum segments in the radial direction can be significantly lowered. Similarly, the dispersion of the movements among the feed drum segments can be significantly lowered.

[0012] In the above described device, it may be possible that the driver includes a drive gear that is engaged with one of the first cam and the second cam.

[0013] With the aforementioned arrangement, the measuring drum segments and the feed drum segments all are simultaneously driven in the radial direction in response to the rotation of the drive gear. Thus the adjustment of the rotational amount of one of the first cam and the second cam can be adjusted precisely, enabling setting of the measuring length with much higher precision.

[0014] In the above described device, it may also be possible that the driver includes a grip attached to one of the first cam and the second cam. With the grip, the operability and workability of the driver is enhanced without necessitating special tools.

[0015] In the above described device, it may be possible that the interlocking member includes a magnet for attracting the first cam and the second cam to each other. With the use of magnet in the interlocking member, the first cam and the second cam are attracted to make contact to each other by the magnet immediately after the lock state of the first cam and the second cam is released thus the interlocking state of the first cam and the second cam is securely maintained without special operations, preventing inadvertent displacement between the measuring drum segments and the feed drum segments.

[0016] It is possible that the magnet is attached to both the first cam and the second cam. Because of strengthened attraction force generated by pair of magnets, the first cam and the second cam are more securely held to each other to maintain the interlocking state therebetween.

[0017] Furthermore, it may be possible that the interlocking member includes a ring for interlocking the first cam and the second cam. Use of the ring mechanically secures the interlocking state between the first cam and the second cam. The ring is to be placed on one of the first cam and the second cam when the apparatus is in the normal waft winding operation. Further, for the purpose of achieving proper holding force, the ring may be in split to enable elastic displacement in the radial direction thereof or may be made in the form of elastic material such as rubber. The ring may be placed on the first cam and the second cam to interlock the same via a slip prevention means such as a gear and spline structure.

[0018] It may also be possible that the interlocking member includes a connecting pin attached to one of the first cam and the second cam and the connecting pin is engageable with the other one of the first cam and the second cam. With the connecting pin, the first cam and the second cam can be interlocked. The connecting pin may also be mounted on one segment of a hinge attached to one of the first cam and the second cam. Furthermore, the connecting pin may also be in the form of bolt provided on one of the first cam and the second cam.

[0019] The above and other objects, features and advantages of the present invention will become apparent upon reading of the following detailed description along with the drawings.

Brief Description of the Drawings:

[0020]

Fig. 1 is a perspective disassembled diagram showing essential parts of the weft diameter setting device as one embodiment of this invention;

Fig. 2 is an explanatory sectional diagram for showing an entire structure of the weft setting device as one embodiment of this invention;

Fig. 3A is a perspective view showing a measuring drum segment and a feed drum segment of Figs. 1 and 2;

Fig. 3B is a sectional view showing an engagement state of a measuring drum segment with a drum segment holder of Figs. 1 and 2;

Fig. 3C is a perspective view showing a feed drum segment of Figs. 1 and 2;

Fig. 3D is a sectional diagram showing an engagement state of a feed drum segment with a drum segment holder;

Fig. 4 is a diagram showing a feed movement of a feed wing of a feed drum segment with respect to a measuring drum segment during the weft winding operation;

Fig. 5 is an explanatory diagram showing a movement of each element during a drum diameter change operation;

Fig. 6 is a cross sectional diagram, corresponding to Fig. 5, showing an essential part in accordance with one alternate form of the embodiment of this invention;

Fig. 7 is a cross sectional diagram, corresponding to Fig. 2, showing an essential part in accordance with another alternate form of the embodiment of this invention;

Fig. 8 is an explanatory diagram showing a movement of each element in Fig. 7 during a drum diameter change operation;

Fig. 9 is a cross sectional diagram, corresponding to Fig. 2, showing an essential part in accordance with yet another alternate form of the embodiment of this invention;

Fig. 10 is an explanatory diagram showing a movement of each element in Fig. 9 during a drum diameter change operation;

Fig. 11 is a cross sectional diagram, corresponding to Fig. 2, showing an essential part in accordance with *still* another alternate form of the embodiment of this invention;

Fig. 12 is an explanatory diagram showing a movement of each element in Fig. 11 during a drum diameter change operation;

Fig. 13 is a perspective view showing an alternate for of a ring material;

Fig. 14 is a cross sectional explanatory diagram showing an alternate form of an interlocking mechanism;

Fig. 15 is a cross sectional explanatory diagram showing another alternate form of an interlocking mechanism;

Fig. 16A is a plan view showing an alternate form of a drive mechanism;

Fig. 16B is a side view showing the alternate form of a drive mechanism.

Detailed Description of the Preferred Embodiments of the Invention:

[0021] Hereinafter, embodiments of this invention are described along with drawings.

[0022] With reference to Figs 1 and 2, an weft diameter setting device for an weft measuring and storing apparatus includes as its essential elements a first cam 13 (as a drive member of cam means)which moves a plurality of measuring drum segments 11, 11 simultaneously in a radial direction, a second cam 23 which moves a plurality of feed drum segments 21, 21, simultaneously in a radial direction, a drive mechanism (as a driver) having a drive gear 31, and an interlocking mechanism having a plurality of magnets 41, 42. Before getting into details to ease the understanding of the following description, directionality of the device need to be defined as follows: "axial direction" is defined as a direction along with the center line C of a rotary shaft 62; "forward" or "front" is defined to be on right hand side of Fig. 2; "backward" or "rear" is defined to be on left hand side of Fig. 2; and "radial direction" is defined to be a radial direction with respect to the center line C of the rotary shaft 62. In addition, a term "cam means" is used to include a cam which functions as a driver and a driven member which is driven by the driver (cam). Therefore, when only the term "cam" is used in the subsequent description, it implies a cam that drives another member.

[0023] The weft measuring and storing apparatus is driven by a rotary shaft 62. The rotary shaft 62 is included in a casing 61 fixed on an unillustrated machine base and is connected to an unillustrated motor. A rotary yarn guide 64 is extended from the rotary shaft 62 in a slanted manner and a weft guide passage 64a for guiding weft Y from an unillustrated weft supply is continuously formed through the unillustrated motor shaft, the rotary shaft 62, and the rotary weft guide 64. In Fig. 2, part of the weft guide passage 64a through the rotary weft guide 64 is shown. A drum holder 63 is rotatably supported on the rotary shaft 62 via bearings 62a. In between the drum holder 63 and the casing 61, a space 65 is defined to allow rotation of the rotary weft guide 64.

[0024] On the opposing surfaces between the drum holder 63 and the casing 61, there is provided magnets 63a on the drum holder side 63 and magnets 61a on the casing side 61. Thanks to the attraction force generated between the magnets 61a, 63a on both sides, the drum holder 63 can sustain its stationary posture despite the rotational movements of the rotary shaft 62 and the rotary weft guide 64.

[0025] A sleeve 25 having step configuration is encasing the top portion of the rotary shaft 62 and the sleeve 25 is fixed via a stop plate 25c and a stop screw 25d onto the rotary shaft 62. The axial positions of the bearings 62a are determined by the sleeve 25, a collar 62c, and an end plate 62b respectively. At the lead end of the sleeve 25, there is formed an eccentrically inclined shaft 25a. An axis C1 of the eccentrically inclined shaft 25a is shifted by an amount δ from an axis C of the rotary shaft 62 in a direction normal to the plane of Fig. 2 and is slanted by an amount θ with respect to the axis C shown in Fig. 2. An inclined sleeve 26 is mounted onto the eccentrically inclined shaft 25a via a bearing 25b.

[0026] A disk like drum segment holder 12 is placed on a front side of the drum holder 63. On the front surface of the drum segment holder 12, a cruci-form guide grooves 12a are formed and in the middle of the drum segment holder 12, a boss 12b is formed. It is set that a guide block 11a (as a driven member of the cam means) is slidable in a radial direction along each guide groove on the guide groove 12a.

[0027] Each measuring drum segment 11 has an arc shape weft wind portion 11b, a slanted surface 11c in the form of part of cone (see Fig.1 and Fig. 3A) formed on the end of the weft wind portion 11b, and a guide block 11a in the upright posture formed at the axial end of the measuring drum segment 11. A plurality of elongated holes extending in the axial direction are formed on the weft wind portion 11b and part of the slanted surface 11c and a plurality of engaging pins 11d are arranged at equi-distance on the frontal surface of the guide block 11a.

[0028] The first cam 13 is a hollow cylinder like member (see Figs. 1 and 2) to rotatably fit around the boss 12b of the drum segment holder 12. Plural magnets 41 are embedded on the front end surface of the first cam 13 and spiral grooves 13a are formed on the rear end surface of the first cam 13 to be engaged with the engaging pins 11d provided on each measuring drum segment 11 (see Figs. 1 and 3B). A circular groove 13c is formed along an inner surface of the first cam 13 at an axial position corresponding to a front of the boss 12b when assembled such that a flange portion of halfdivided fixing ring 14 is enclosed in the groove 13c.

[0029] A disk like drum segment holder 22 is fixed on the front end surface of the inclined sleeve 26 via bolts 26a. On the rear surface of the drum segment holder 22, there is formed a cruci-form guide grooves 22a so that the guide block 21a of the feed drum segment 21 is engaged in the guide groove 22a.

[0030] Each feed drum segment 21 has an arc surface 21b with a diameter smaller than that of the measuring drum segment 11 (see Figs. 1 and 3C) and four of feed wings 21e extending in the axial direction formed on the arc surface 21b. The feed wings 21e of the feed drum segment 21 project from the weft wind surface 11b of the measuring drum segment 11 through the elongated hole 11e when the feed drum segment 21 is placed in the measuring drum segment 11 as in the assembled posture. The guide block 21a extending in radially inwardly direction is formed at the front end of the arc surface 12b and on this guide block 21a, a plurality of engaging pins 21d extending rearward in the axial direction are arranged at the equal pitch.

[0031] The second cam 23 is supported on the inclined sleeve 26 on the rear of the feed drum segment 21 via semi-circular fixing rings 24 (see Figs 1 and 2). The fixing rings 24 are encased in a circular groove 23c formed along the inner surface of the second cam 23 and are positioned with respect to the inclined sleeve 26 via a step portion 26d, and a stop ring 26c. However, there is set to form proper clearances between the fixing rings 24 and the inclined sleeve 26 and the fixing rings 24 and a groove 23c respectively, thus the second cam 23 can be inclined and moved with respect to the inclined sleeve 26 upon loosening of the bolts 22c fixing the fixing rings 24 and bolts 26a fixing the drum segment holder 22.

[0032] Spiral grooves 23a are formed on the front end surface of the second cam 23 to be engageable with engaging pins 21d of each feed drum segment 21 (see Figs. 1 and 3D). Magnets 42 attracted by the magnets 41 of the first cam 13 are embedded on the rear end surface of the second cam 23 (see Figs. 1 and 2). Note that magnets 42 and magnets 41 are set to be attracted to each other. An outer gear 23b is formed around an outer rim of the second cam 23 and is in mesh with a drive gear 31 having a much smaller diameter. A rotary pin 31a extends from the drive gear 31 and is prevented from being axially displaced by a ring 31c with a stop screw 31b.

[0033] The fixing rings 14 each is fixed on the boss 12b of the drum segment holder 12 via a bolt 12c which is screwed onto the boss 12b. The bolt 12c axially through the fixing ring 24 from the front side of the drum segment holder 22 tightens up the fixing ring 14 onto the boss 12b thereby the first cam 13 enables to lock the measuring drum segments 11 via fixing rings 14. The fixing rings 24 are screwed by the bolts 22c from the front side of the drum segment holder 22 thereby the second cam 23 enables to lock the feed drum segments 21(disabling rotation of the feed drum segment) via fixing rings 24.

[0034] On the measuring drum segment 11, a hole 11f is formed for an control pin 67 to come in and out which is driven by a solenoid 67a. When the rotary weft guide 64 is rotated via the rotary shaft 62, the rotary weft guide 64 winds an weft from the weft guide passage 64a around the weft wind portion 11b of the measuring drum segment 11. When the control pin 67 is placed in the hole 11f, weft wound around the wind portion 11b is prevented from being released to forward and when the control pin 67 is out of the hole 11f, then weft wound around the wind portion 11b is permitted to be released to forward. Now, the measuring drum segments 11 are prevented from rotation along the rotation of the rotary shaft 62 due to the attraction force generated between the magnets 61a and the magnets 63a, similarly the feed drum segments 21 remain stationary due to the attraction force generated between the magnets 41 and the magnets 42. Thus the magnets 41 and the magnets 42 together form a rotation prevention mechanism which prevents relative rotation between the first can 13 and the second cam 23.

[0035] While the feed drum segments 21 are united with the drum segment holder 22, the second cam 23 and the inclined sleeve 26 via the bolts 22c and the fixing ring 24. And the inclined sleeve 26 is supported on the eccentrically inclined shaft 25a of the sleeve 25 via the bearing 25b. Thus the feed drum segments 21, in response to the rotation of the rotary shaft 62, i.e., the rotation of the rotary weft guide 64, produce a certain weft feed movement in accordance with the amount of eccentricity δ and the inclined angle θ.

[0036] More specifically, when looking at one particular feed wing 21e of the feed drum segment 21, assuming the feed wing 21e starts its movement in the elongated hole 11e of the measuring drum segment 11 at a first state where as shown in a solid line in Fig. 4 the feed wing 21e is most backwardly inclined to a second state, indicated by an arrow K1, where the wound weft Y on the weft wind portion 11b of the measuring drum segment 11 is raised (radially outward; shown in a dash and dot line), and then the wound weft Y is moved radially inward while keeping a forwardly inclined posture to a third state, as indicated by arrow K2, where the weft Y is put back on the wind portion 11b of the measuring drum segment 11 to advance the weft Y to the front by one pitch. Subsequently, the feed wing 21e is being inclined backward while lowering its height (moving toward radially inwardly) as indicated by an arrow K3 and a double dot and dash line to restore indicated by an arrow K4its original posture that is indicated by a solid line.

[0037] The feed wing 21e fluctuates in a radial direction by an amount 2δ around the weft wind surface 11b of the measuring drum segment 11. Further, the feed wing 21e fluctuates its angular posture in the axial direction by an angle of 2θ. The amount h is defined by subtracting the radial height of the weft wind surface 11b from the maximum possible radial height of the feed wing 21e; this obtained amount h defines a yarn pitch to be arranged over the weft wind surface 11b. It is to be understood that all the feed wings 21 are set to produce a certain height h with respect to corresponding measuring drum segments 11.

[0038] Hereinafter, the method of changing the measuring amount of the weft Y, equivalent to change a diameter of the drum that is set by the weft wind surfaces 11b of the respective drum segments 11, is described.

[0039] First of all, the bolts 12c, 22c are loosened to disengage the lock states of the measuring drum segments 11 and the feed drum segments 21 (see Fig. 5). Thereafter, the bolts 26a are loosened to allow the drum segment holder 22 to hang vertically freely, that in turn permits the drum segment holder 22 to be in parallel with the drum segment holder 11 and thereby the first cam 13 and the second cam 23 are attracted to each other by the attraction force generated between the magnets 41 and the magnets 42. At this time, the first cam 13 is advanced forward by an amount L1 and the second cam 23 is moved backward by an amount L2. Where the second cam 23 is allowed to move backward when the fixing rings 24 are inclined within the circular groove 23 with respect to the inclined sleeve 26.

[0040] Subsequently, when the drive gear 31 is rotated by the rotation pin 31a, the second cam 23 rotates around the fixing rings 24 and this rotation of the second cam 23 moves simultaneously all the feed drum segments 21 in the radial direction of the drum segment holder 22 by an engagement of the engaging pins 21d projected from the guide block 21a of each feed drum segment 21 along the spiral grooves 23a formed on the front end surface of the second cam 23 (see Figs. 3D and 5). At the same time, the rotation of the second cam 23 is transmitted to the first cam 13 through the magnets 42 and the magnets 41 and the rotation of the first cam 13 moves simultaneously all the measuring drum segments 11 in the radial direction of the drum segment holder 12 by the engagement of the engaging pins 11a along the spiral grooves 13a of the first cam 13 (see Figs. 3B and 5).

[0041] It should be noted, however, the moving direction of each feed drum segment 21 and each measuring drum segment 11 in response to the operation of the drive gear 31 which is in mesh with the external gear 23b formed around the circumference of the second cam 23 have to be set in the same direction and also the movement amounts of these in response to the operation of the drive gear 31 have to be set the same as well. To do so, the spiral grooves 13a formed on the first cam 13 are set in opposite in direction to the spiral grooves 23a formed on the second cam 23; however, a lead of the spiral groove of the first cam 13 and that of the second cam 23 in response to the certain amount of the rotation are set equal to each other. Note that the term "lead" used in this context is defined as a displacement of a particular point on the spiral groove in the radial direction caused by a one complete rotation of the cam.

[0042] By following the above steps, the radial position of each measuring drum segment 11 and the same of each feed drum segment 21 are set. Thereafter, all the previously loosened bolts 12c, 22c are tightened up to lock the measuring drum segments 11 and the feed drum segments 21. When the bolts 26a are tightened up, then the drum diameter setting device is all set for its normal weft winding operation.

[0043] In this invention, each of the spiral grooves 13a of the first cam 13, each of the spiral grooves 23a of the second cam 23, the engaging pins 11d of each measuring drum 11, and the engaging pins 21d of each feed drum segment 21 are not necessarily limited to the forms (shapes) and numbers described in the above passages. Rather, these elements may be in different forms (shapes) and in different numbers other than what is disclosed in the above passages; nevertheless, these possible alternate forms are considered to be in the scope of this present invention. Similarly, the number of the measuring drum segments 11 and the number of feed drum segments 21 are not necessarily in numbers illustrated in the previously recited drawings but may be in two or arbitrary number more than two to realize this present invention. The same is true for the feed wings of each feed drum segment 21 and corresponding elongated holes 11e of each measuring segment 11. Thus they may be set in arbitrary numbers as design choice.

Alternate forms of the embodiment of this invention:

[0044] As one of the alternate forms of the aforementioned embodiment, the magnets 31 of the first cam 13 may be embedded in a front surface of the ring-shaped drive member 43 as shown in Fig. 6.

[0045] On the rear surface of the drive member 43, a drive pin 43a is mounted and the drive pin 43a is engaged in a radially extended groove 13a formed on the front surface of the first cam 13. Where, a single pair of the drive pin 43a and the groove 13d may be sufficient for its intended function; however, there certainly will be considered to be the design choice to set the number of these pairs. Yet, the groove(s) 13d is/are to be formed along the radial direction of the first cam 13. Further, the outer rims of the fixing rings 14 are encased in the circular groove 43c formed along the inner surface of the drive member 43.

[0046] When the bolts 12c are loosened, the drive member 43 is shifted to forward and in turn the magnets 41 and the magnets 42 are attracted to each other. Thus regardless of the forward and backward movements of the first cam 13 and the second cam 23 respectively, the first cam 13 and the second cam 23 are set interlocked to each other. In other words, the engagement state of the drive pin 43a in the radially extended groove 13d, though the drive member 43 is advanced to forward, is maintained; therefore, in this alternate form, the interlocking state between the first cam 13 and the second cam 23 is maintained by the drive member 43, the drive pin 43a, and the groove 13d in addition to the magnets 41 and the magnets 42.

[0047] In another alternate form of the embodiment, as shown in Fig. 7, the first cam 13 can be fixed on the boss 12b of the drum segment holder 12, i.e., unable to move in the axial direction, and the second cam 23 and the drum segment holder 22 can be mounted on an enlarged portion 26e of the inclined sleeve 26 via the fixing ring 24.

[0048] In this alternate form, the first cam 13 can lock the measuring drum segments 11 by tightening up a fixing screw 53. The second cam 23 can lock the feed drum segments 21 by uniting the feed drum segments 21 with the drum segment holder 22 and the second dam 23 and the fixing ring 24 upon tightening up the bolt 22c. Moreover, the second cam 23 can be united with the inclined sleeve 26 via the fixing ring 24 by tightening up a bolt 26b which is operable from the front side of the drum segment holder 22. It should be noted, however, the fixing ring 24 has to be in the form of a continuous ring and the proper number of the bolts 22c and the proper number of the bolts 26 are to be provided to the fixing ring 24.

[0049] When the need arises to change the drum diameter with the aforementioned alternate form, first of all, a fixing screw 53 is loosened to enable free rotation of the first cam 13, second, bolts 26b, 22c are loosened to allow movement of the second cam 23 in the rearward direction, realizing the contact state of the magnets 41 and the magnets 42, and free rotation of the second cam 23, thereby releasing the lock states of the measuring drum segments 11 and the feed drum segments 21 respectively. Note that there is to be an adequate clearance between the inner circular surface of the second cam 23 and the external surface of the enlarged portion 26e of the inclined sleeve 26 so that the second cam 23 is allowed to tilt with respect to the inclined sleeve 26 by an amount equivalent to the inclination angle θ of the eccentrically inclined shaft 25a. It should also be noted that the thickness of the enlarged portion 26e of the inclined sleeve 26 in the axial direction is preferably set smaller for the purpose of easing the inclination of the second cam 23.

[0050] In yet another alternate form of the embodiment, the second cam 23 can be mounted on the inclined sleeve 26 without allowing the relative movement of the second cam 23 along the inclined sleeve 26 in the axial direction as shown in Fig. 9.

[0051] In this alternate form, the second cam 23 locks the feed drum segments 21 by tightening up screw bolt(s) 26f onto the enlarged portion 26e of the inclined sleeve 26 with the drum segment holder 22 interposed therebetween. Note that only a single screw bolt 26f is shown in Fig. 9; however, the present invention is no way limited to this illustration. When the need arises to change the drum diameter with this alternate form with reference to Fig. 10, each screw bolt 26f is slightly loosened to allow free rotation of the second cam 23 and to release the lock state of the feed drum segments 21.

[0052] As shown in Figs. 9 and 10, the inclined sleeve 26 is maintained its stationary posture by an attraction force generated between plural magnets 51 embedded in the boss 12b of the drum segment holder 12 and opposingly provided plural magnets 52 embedded in the rear portion of the inclined sleeve 26. Accordingly, the first cam 13 maintains lock state of the measuring drum segments 11 due to the magnets 42 and the magnets 41 as long as the second cam 23 is kept in non-rotation state (i.e., stationary state). As a result, the first cam 13 enables the movement of the measuring drum segments 11 in the radial direction in response to the rotation of the second cam 23.

[0053] Note that the magnets 41 and the magnets 42 together form a rotation prevention mechanism which is to prevent the relative rotation between the first cam 13 and the second cam 23. In addition, the same elements further form an interlocking mechanism which is to interlock the movements of the first cam 13 and the second cam 23.

[0054] Furthermore, the second cam 23, upon loosening of the bolts 26f, can be rotated in either one of the ways with its posture being inclined to the first cam 13 and with its posture being parallel to the first cam 13 yet being inclined to the inclined sleeve 26. However, the attraction force generated between the magnets 41 and the magnets 42 is set strong enough so that the second cam 23 remains being made contact with the first cam 13 even after loosening the bolts 26f.

[0055] In yet another alternate form of the embodiment, the interlocking mechanism between the first cam 13 and the second cam 23 can be formed in the ring member 44 as shown in Fig. 11 in place of a combination of the magnets 41 and the magnets 42 in the aforementioned forms. In this alternate form, an internal gear 44a is formed around an inner surface of the ring member 44 and an external gear 13e and an external gear 23d are formed around the front portion of the first cam 13 and rear portion of the second cam 23 respectively. Where, the external gear 13e and the external gear 23d are set to be in mesh with the internal gear 44a. Moreover, during the normal weft winding operation, the ring member 44 is placed over the first cam 13.

[0056] When the need arises to change the drum diameter with this alternate form with reference to Fig. 12, first of all, each of the bolts 26f is slightly loosened, then the ring member 44 is shifted forward to the side of the second cam 23 as indicated by an arrow K6 to set the gear 44a in mesh with both the gear 13e and the gear 23d, and then the fixing screw 53 is loosened to allow interlocking state of the first cam 13 and the second cam 23. Note that as shown in Figs, 11 and 12, the magnets 51, the magnets 52, the fixing screw 53 and the bolts 26f all together form a rotation prevention mechanism which is to prevent the relative rotation between the first cam 13 and the second cam 23. Further, what is required to the ring member 44 is that the ring member 44 can be mounted on one of the first cam 13 and the second cam 23 during the normal weft winding operation and that the ring member 44 can interlocks the first cam 13 to the second cam 23 during the drum diameter change operation. Thus the use of a key or a spline or a combination thereof, but not limited thereto, may replace the gears 44a, 13e, 23d as shown in Figs 11 and 12 for fulfilling the above requirements of the ring member 44.

[0057] Accordingly, the ring member 44 can be in the form of the split ring 47 with a cutout portion 47a as shown in Fig. 13. The ring member 47 is set such that during the normal weft winding operation the ring member 47 is elastically mounted on either one of the first cam 13 and the second cam 23, and during the drum diameter changing operation, the ring member 47 can be mounted on both cams 13, 23 to interlock the movements of the first cam 13 and the second cam 23.

[0058] The interlocking mechanism can be made in the form of a hinge structure 45 with a connecting pin 45a to be mounted on the first cam 13 as shown in Fig. 14. The connecting pin 45a is set to project from one segment of the hinge 45 and is in the shape engageable in a recessed portion 23e formed on the second cam 23 and when the connecting pin 45a is engagement with the recessed portion 23e as shown in the solid line in Fig. 14, the first cam 13 and the second cam 23 are put to the interlocking state. Further, during the normal weft winding operation of the apparatus, the hinge 45 is bent its connecting pin to the side towards the first cam 13 as indicated by an arrow K7, thus the engagement state with the recessed portion 23e is released (as shown in double dot and dash line).

[0059] Moreover, the interlocking mechanism can be formed by a connecting pin 46 of the bolt type mounted on the first cam 13 as shown in Fig. 15. As shown in Fig. 15, the lead end portion of the connecting pin 46 is engaged in a recessed portion 23e formed on the rear end portion of the second cam 23 (indicated by a solid line) to interlock the first cam 13 to the second cam 23. Whereas when the apparatus is in normal waft winding operation, the connecting pin 47 is pulled out of the recessed portion 23e (as indicated by an arrow K8) to release the interlocking state between the first cam 13 and the second cam 23 as indicated by a double dot and dash line. Note that a lock nut 46a is provided to the connecting pin 46 to secure fixed position of the connecting pin 46 onto the first cam 13.

[0060] The hinge 45 and the connecting pin 46 shown in Figs. 14 and 15 may also respectively be mounted on the second cam 23 and the recessed portion 23e may also be formed on the first cam 13. Further, the combination of the connecting pin 46 and the recessed portion 23e may also be made in the plural forms placed around circumferences of the first cam 13 and the second cam 23. Similarly the combination of the hinge 45 and the recessed portion 23e may also be made in the plural forms placed around the circumferences of the first cam 13 and the second cam 23. Moreover, the connecting pin 45a and the connecting pin 46 can be in engagement with the recessed portion 23e respectively even during the normal weft winding operation of the apparatus, as long as doing so does not obstruct the movement of feeding the waft.

[0061] The drive mechanism formed by the drive gear 31 and the gear 23b can also be in the form of grip 32 mounted on the second cam 23 as shown in Figs. 16A and 16B. As being obvious, Fig. 16B is a sectional view taken along the line X-X in Fig. 16A. The grip 32 penetrates through an arc shape hole 22d formed on the drum segment holder 22 and when it comes to the drum diameter change operation, the grip 32 is moved along the arch shape hole 22d to rotate the second cam 23.

[0062] Furthermore, the drive gear 31 in the aforementioned descriptions can also be made in mash with the gear of the first cam 13 and the grip 32 in the aforementioned descriptions can also be mounted on the first cam 13.

[0063] Although the present invention has been fully described by way of example with reference to the accompanying drawings, it is to be understood that various changes and modifications will be apparent to those skilled in the art. Therefore, unless otherwise such changes and modifications depart from the scope of the invention defined in the following section, they should be construed as being included therein.

Claims

1. A drum diameter setting device for an weft measuring and storage apparatus, the drum diameter setting device comprising:

   a plurality of measuring drum segments;
   a first cam for moving the plurality of measuring drum segments simultaneously in a radial direction and locking the same;
   a plurality of feed drum segments;
   a second cam for moving the plurality of feed drum segments simultaneously and locking the same;
   a driver for rotating one of the first cam and the second cam; and
   an interlocking member for interlocking the first cam and the second cam.

2. The drum diameter setting device according to claim 1, characterized in that each of the measuring drum segments has an engaging pin that is engaged in a spiral groove formed on the first cam and each of the feed drum segments has an engaging pin that is engaged in a spiral groove formed on

the second cam.

3. The drum diameter setting device according to claim 1 or claim 2, characterized in that the driver includes a drive gear that is engaged with one of the first cam and the second cam.

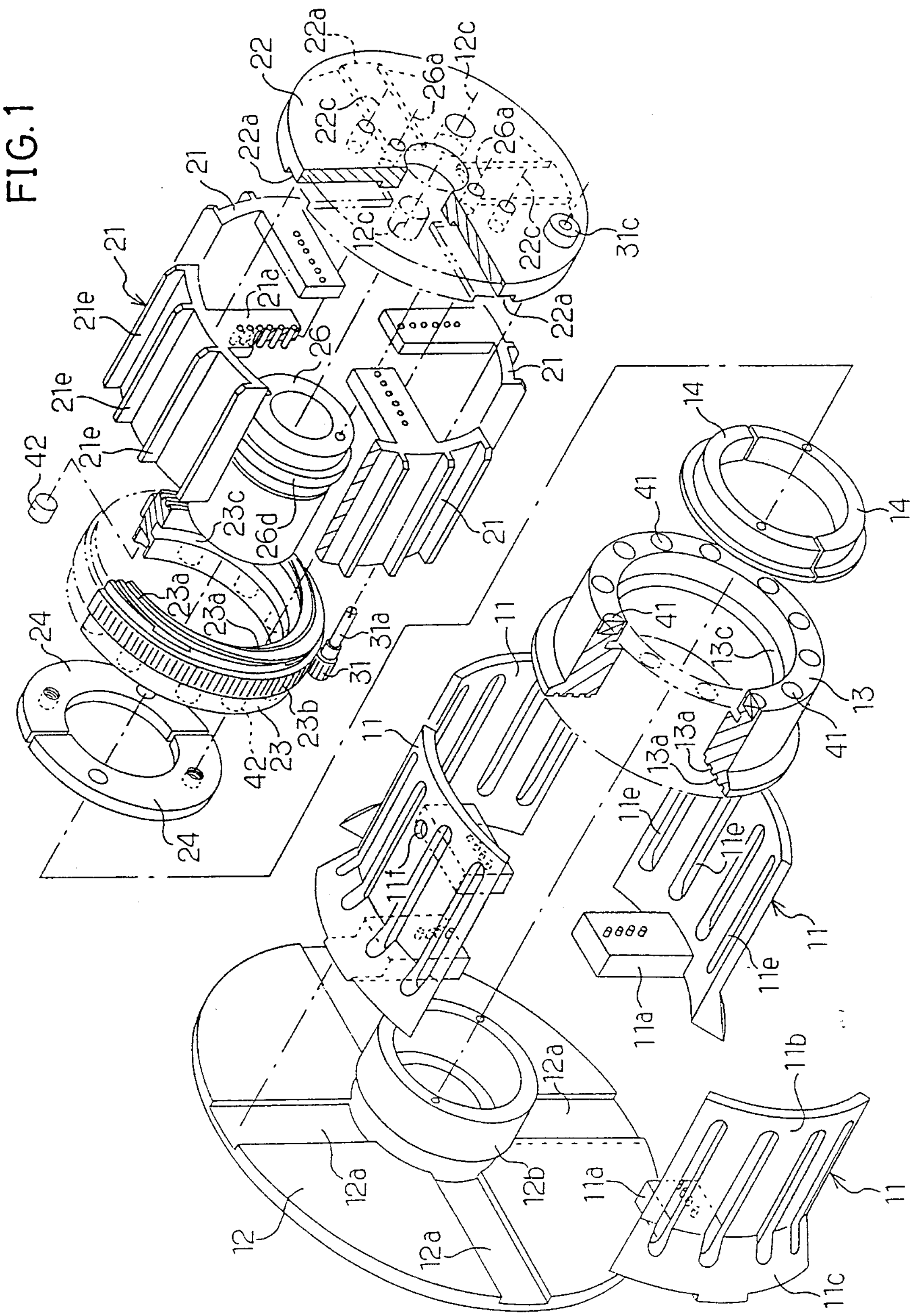
4. The drum diameter setting device according to claim 1 or claim 2, characterized in that the driver includes a grip attached to one of the first cam and the second cam.

5. The drum diameter setting device according to one of claims 1 through 4, characterized in that the interlocking member includes a magnet for attracting the first cam and the second cam to each other.

6. The drum diameter setting device according to claim 5, characterized in that the magnet is attached to both the first cam and the second cam.

7. The drum diameter setting device according to one of claims 1 through 4, characterized in that the interlocking member includes a ring for interlocking the first cam and the second cam.

8. The drum diameter setting device according to one of claims 1 through 4, characterized in that the interlocking member includes a pin attached to one of the first cam and the second cam and the pin is engageable with the other one of the first cam and the second cam.



11
11a
11b
11c
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11f
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13c
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21e
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22a
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26a
26d
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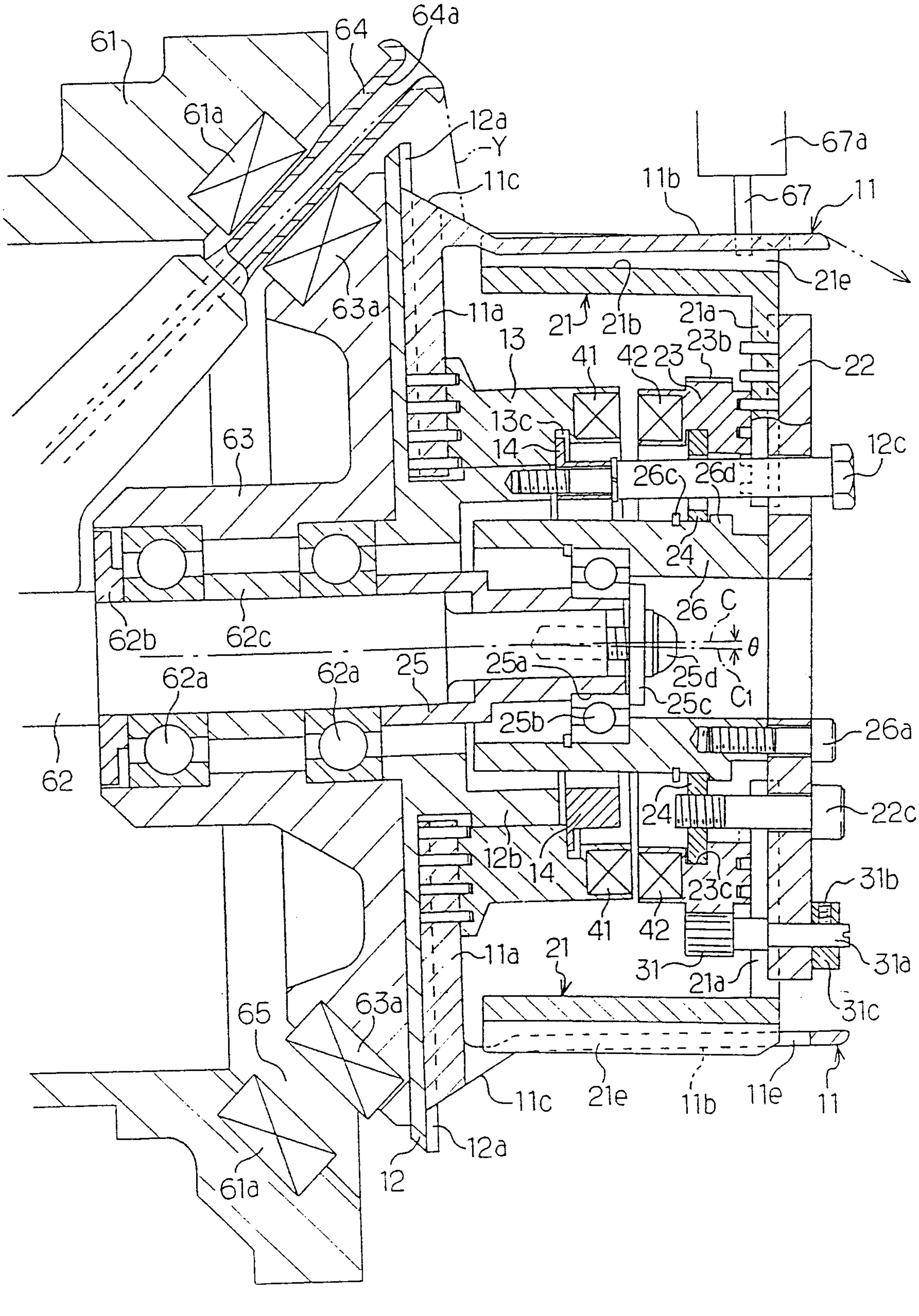
31a
31c
41
42

FIG. 1

FIG. 2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11b
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42
23
23b
22
13c
14
12c
26c
26d
63
24
26
C
θ
62b
62c
C1
25d
62a
25
25a
25c
25b
26a
62
24
22c
12b
14
23c
31b
41
42
11a
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21a
31a
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63a
31c
21e
11b
11e
11c
12a
12
61a

FIG. 3A

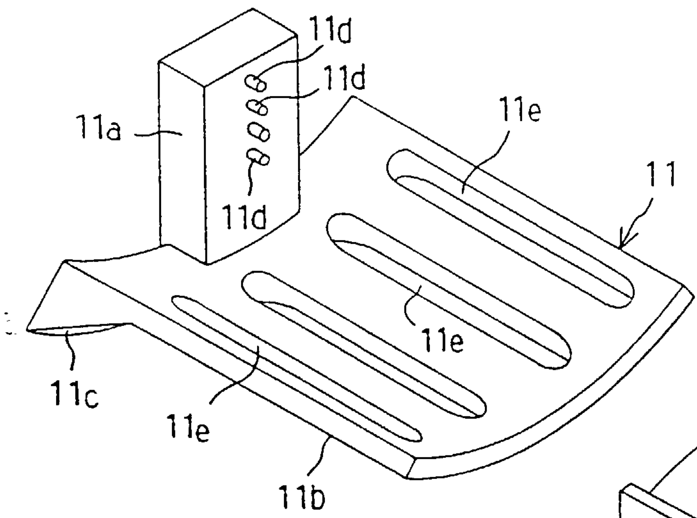


FIG.3C

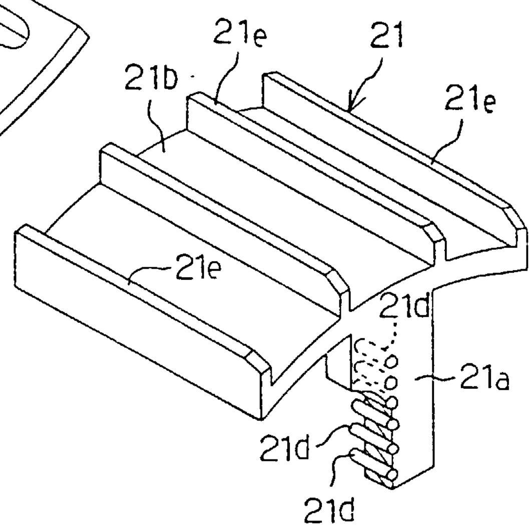


FIG.3B

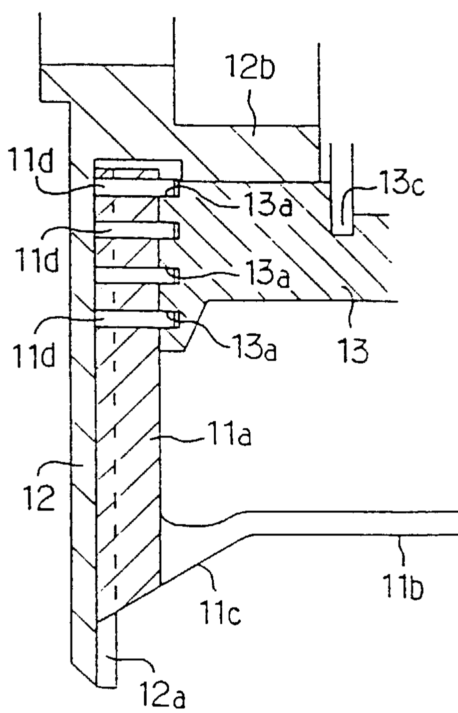


FIG.3D

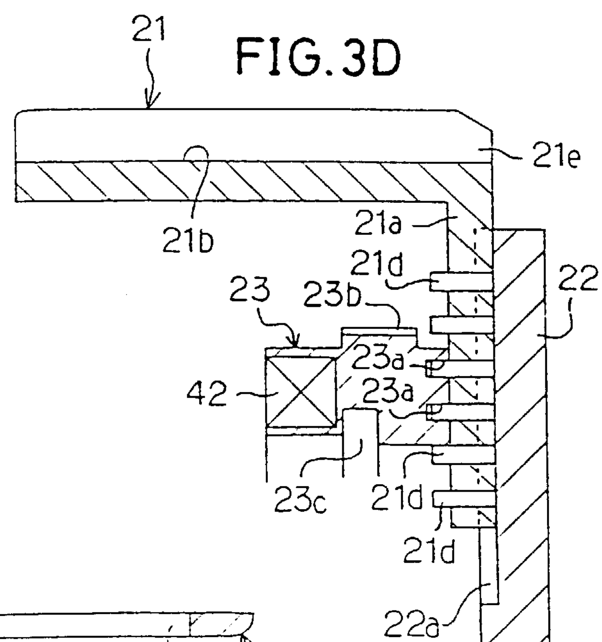


FIG. 4

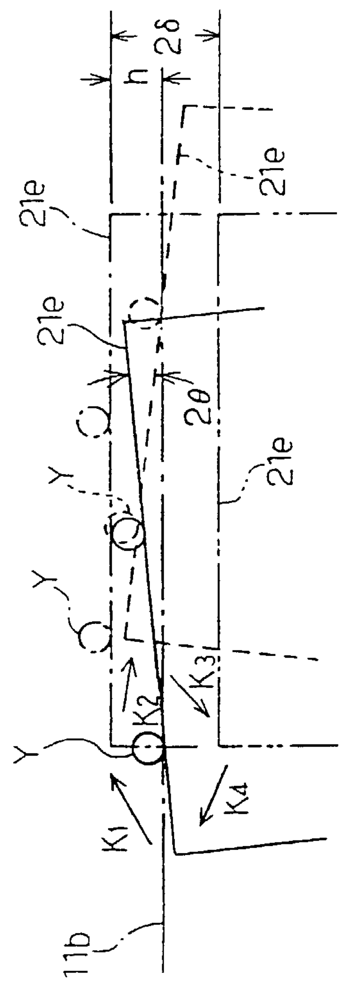
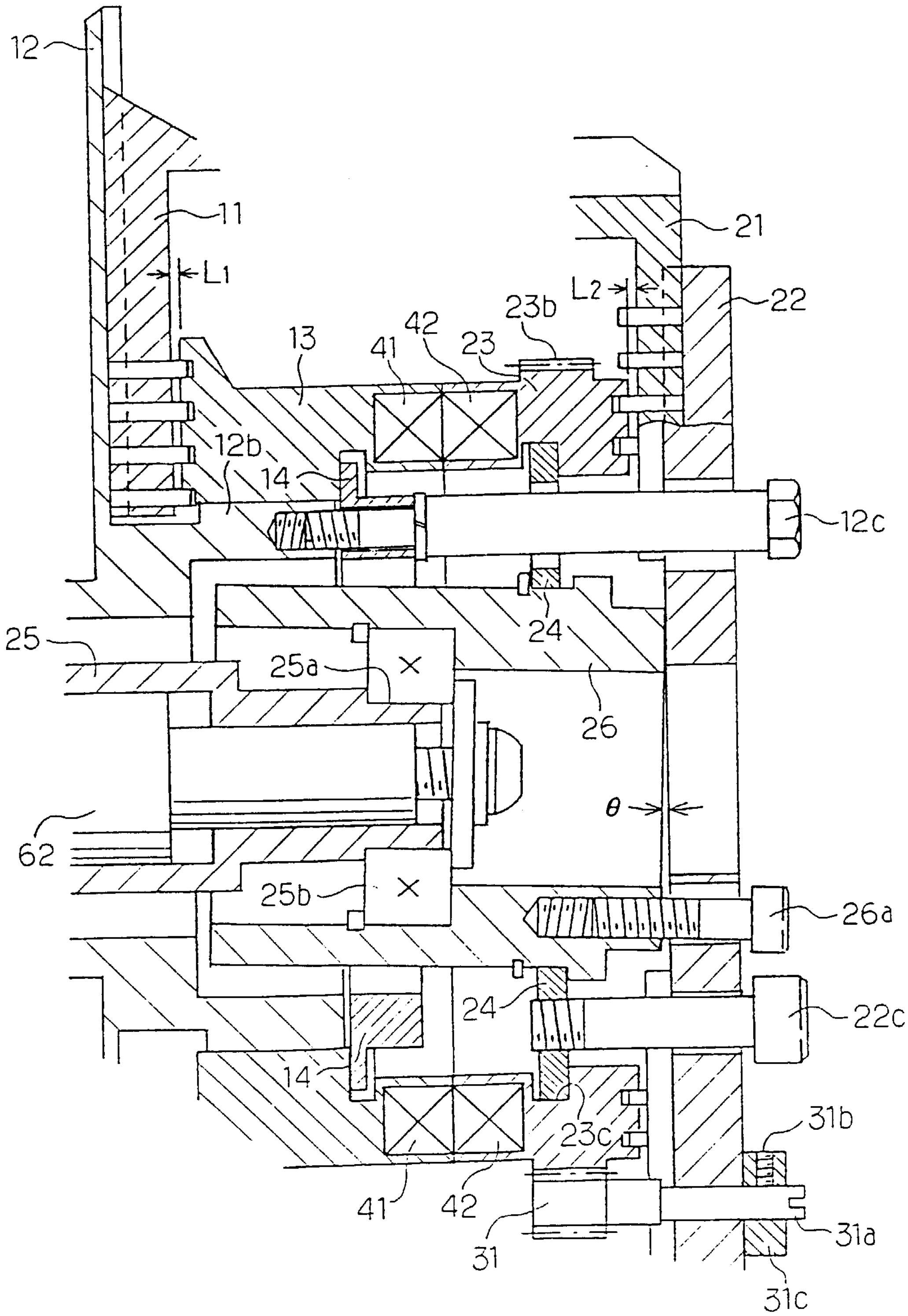


FIG.5


12
11
L1
21
22
L2
23b
42
41
23
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12b
14
12c
24
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25a
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22c
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31a
31
31c

FIG. 6

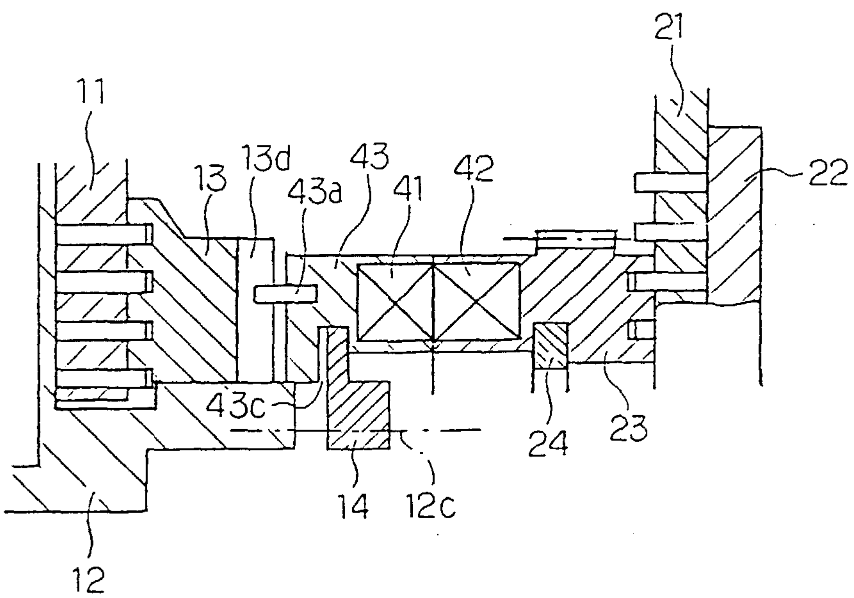


FIG. 7

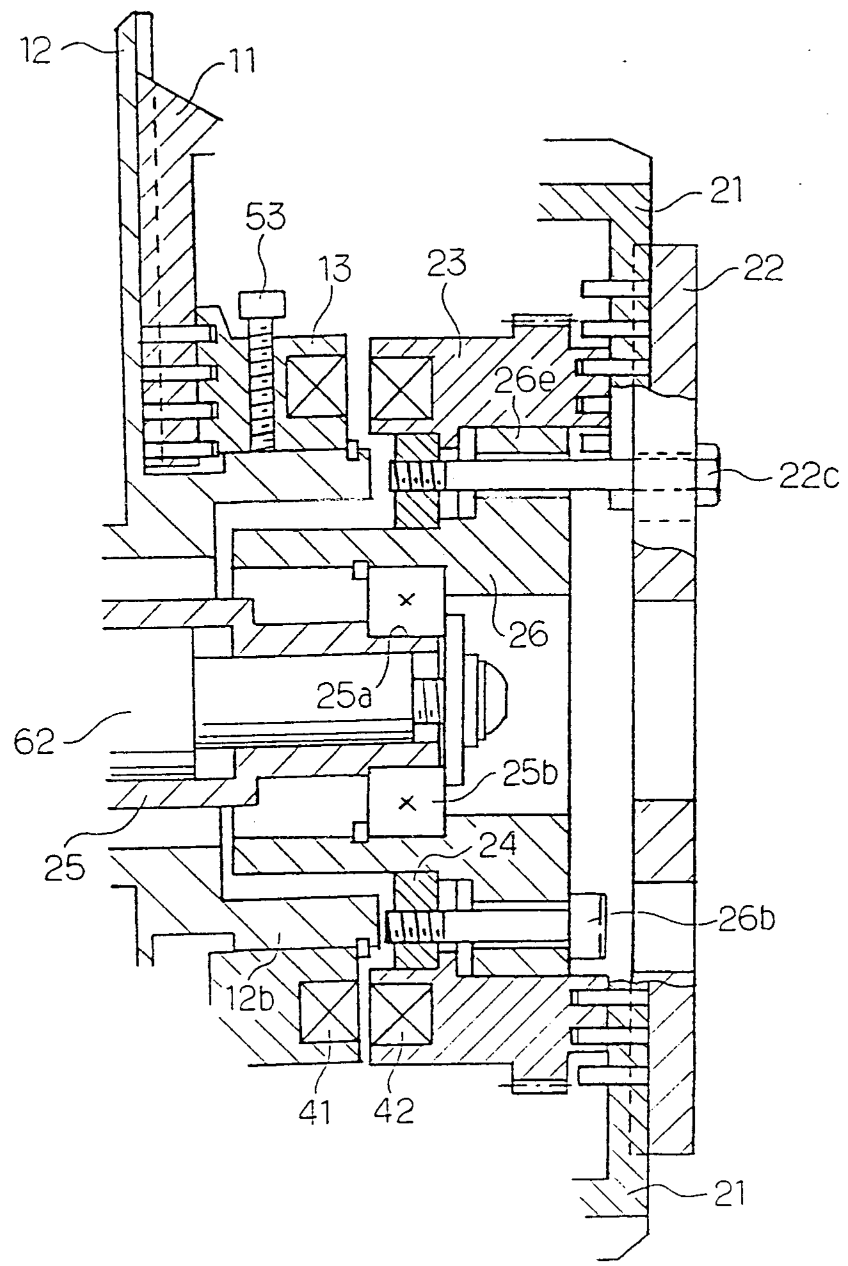


FIG. 8

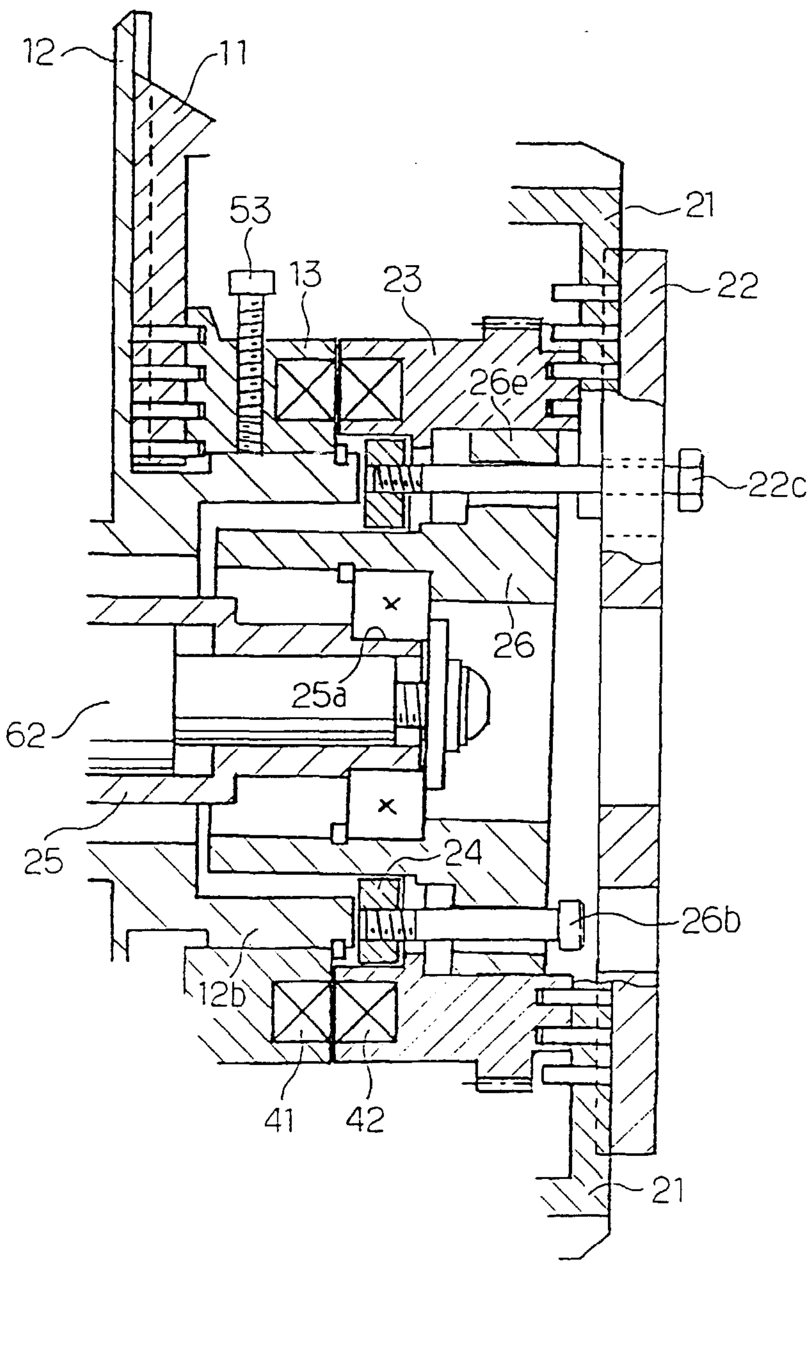


FIG. 9

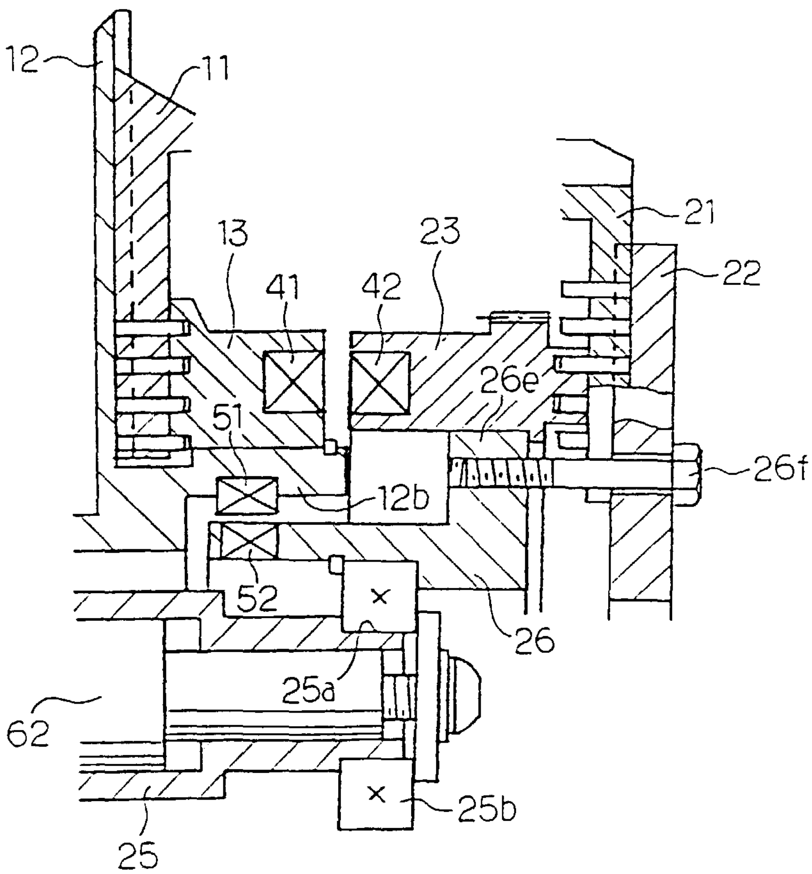


FIG.10

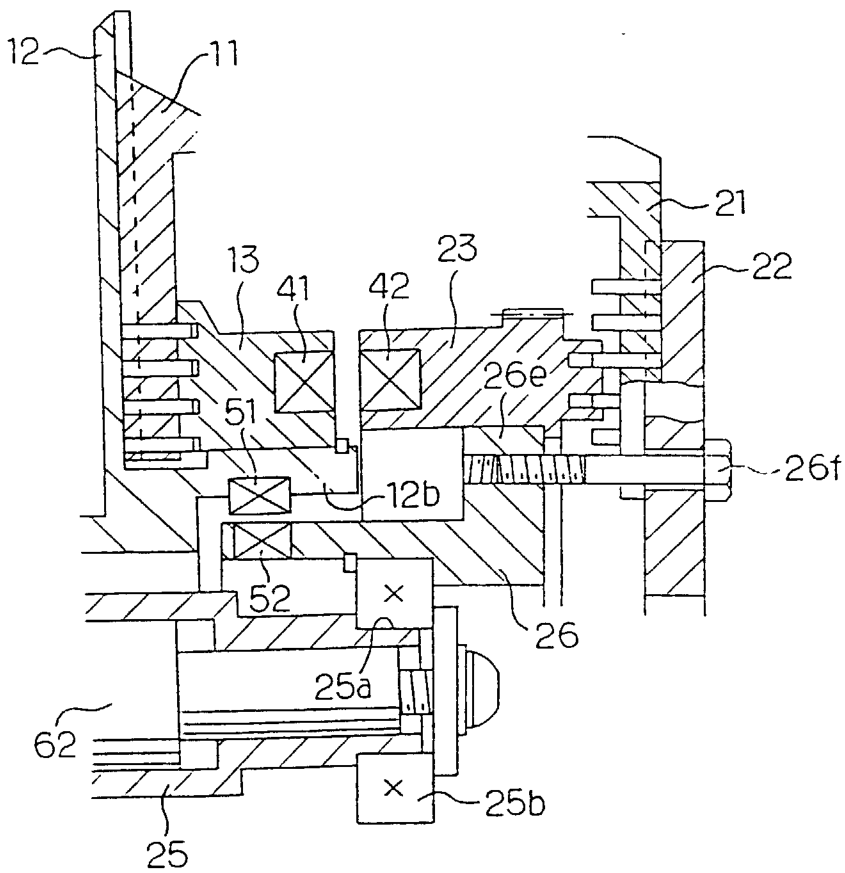


FIG.11

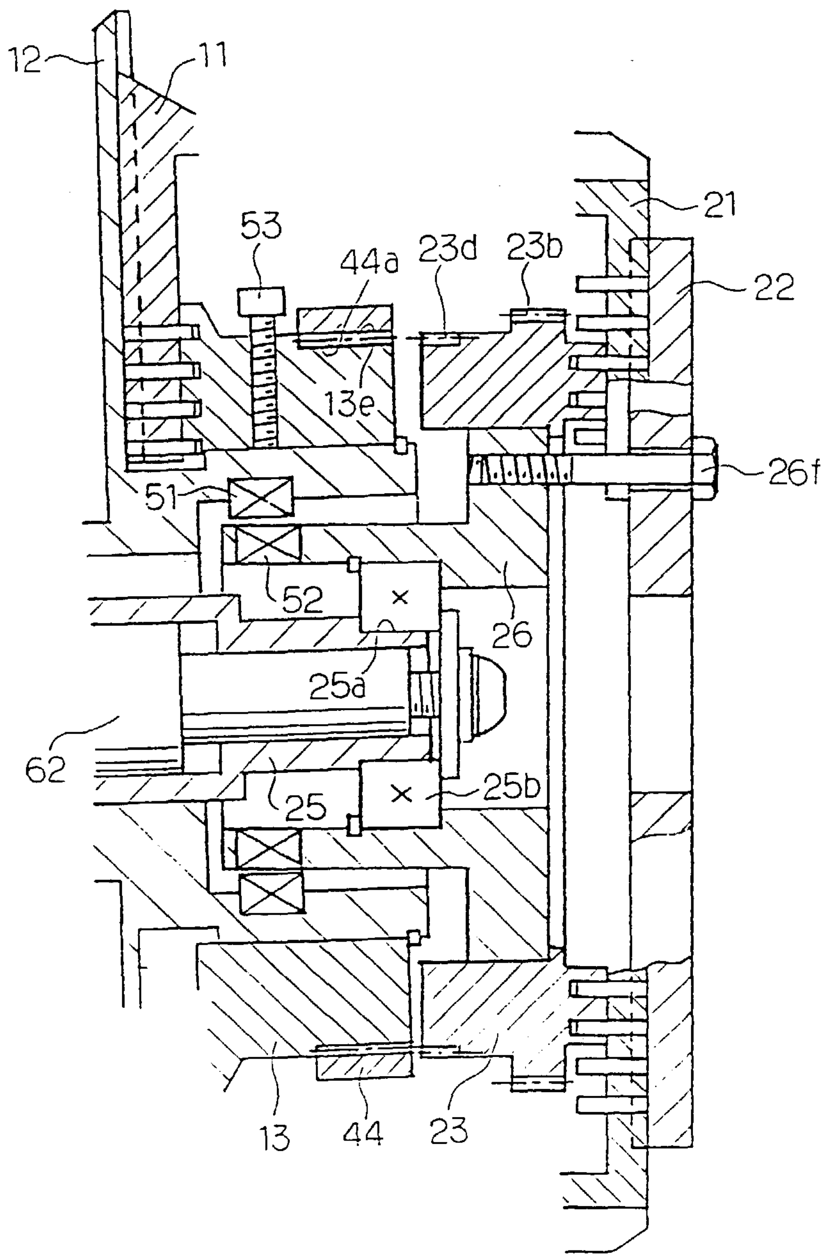


FIG.12

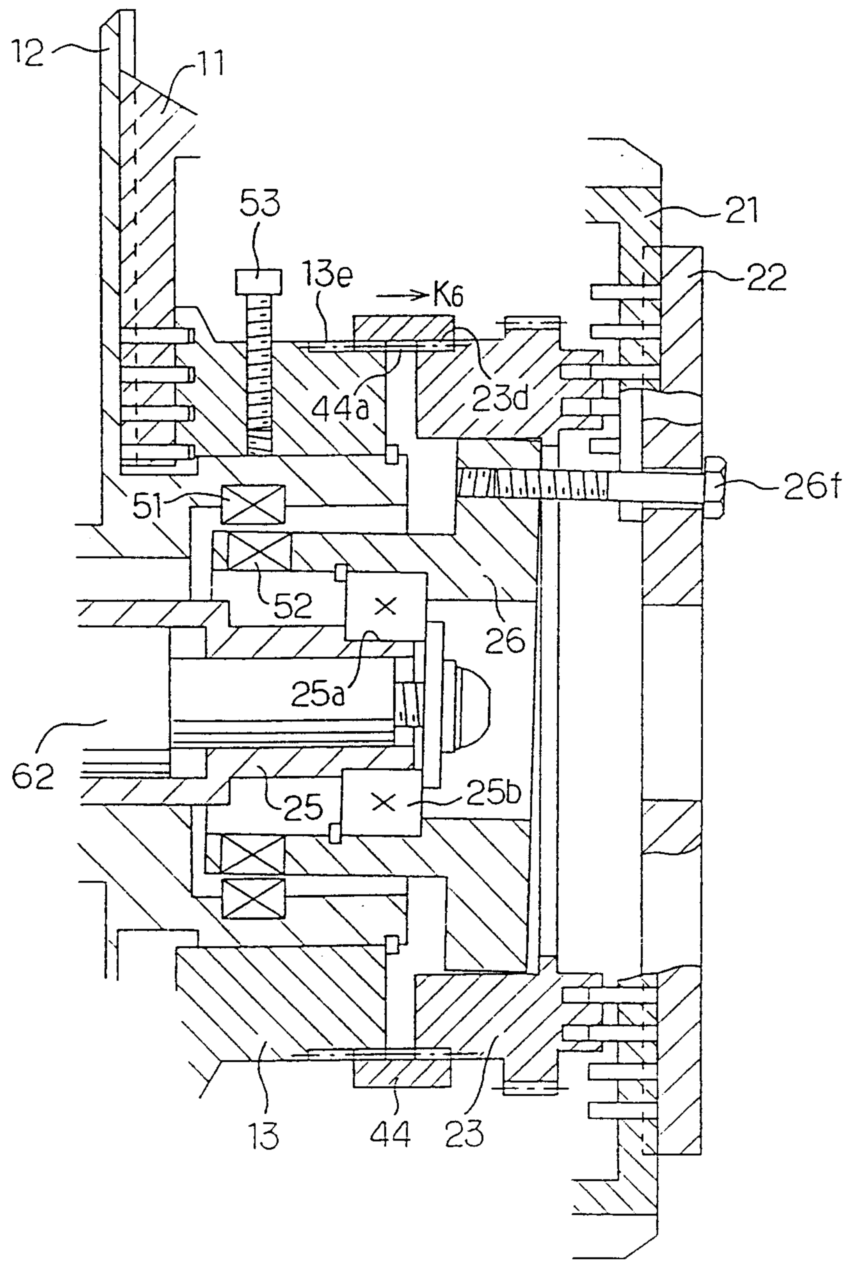


FIG.13

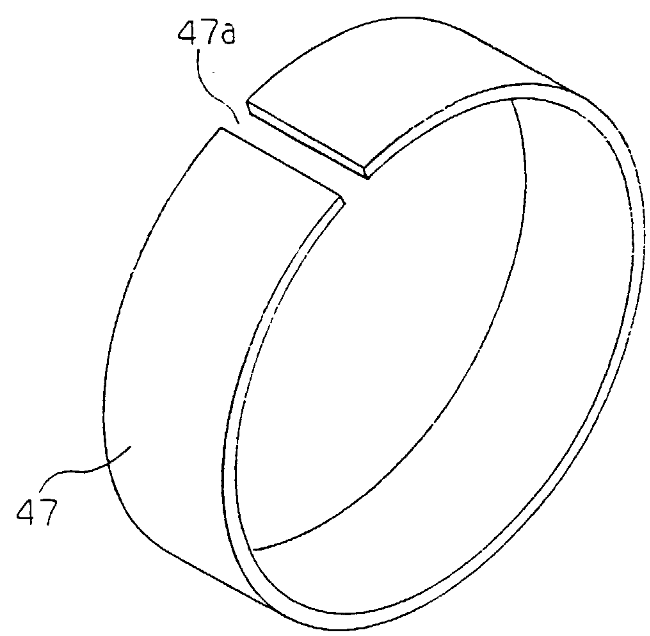


FIG. 14

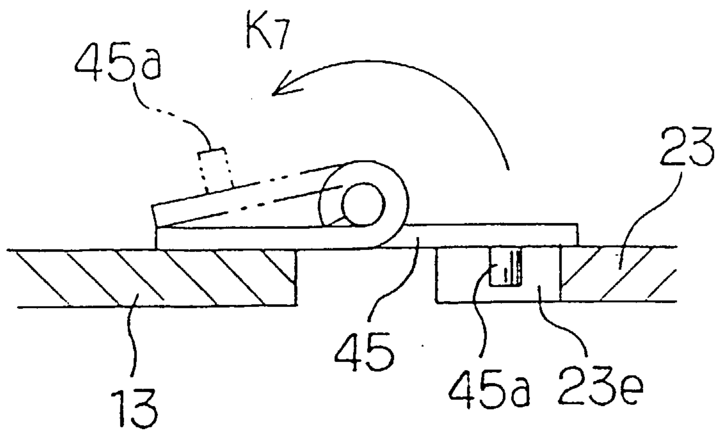


FIG. 15

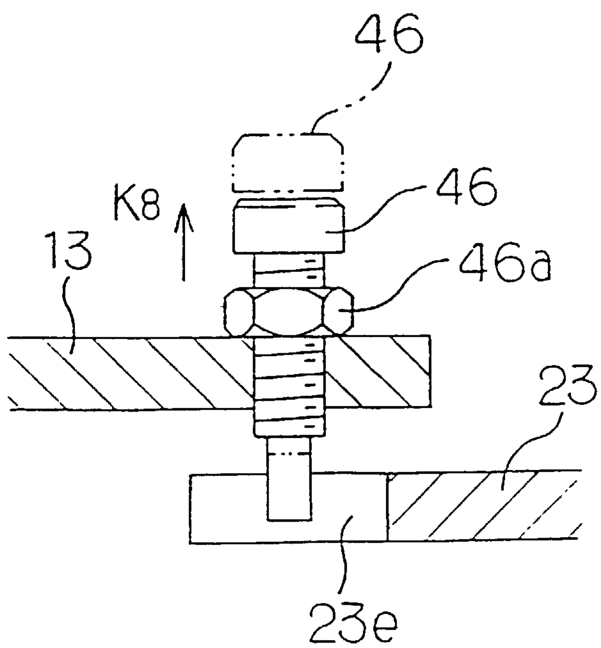


FIG.16A

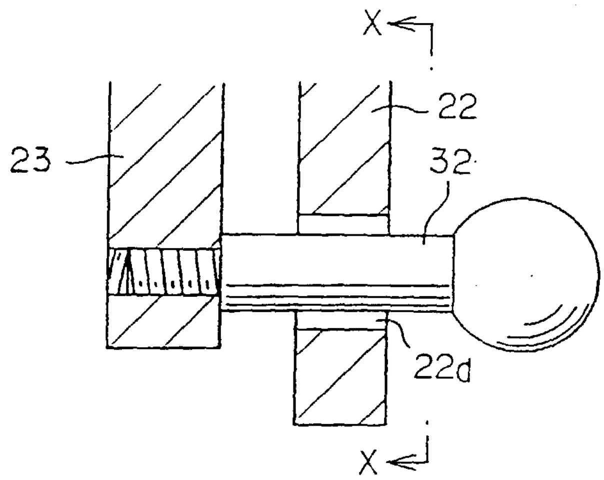
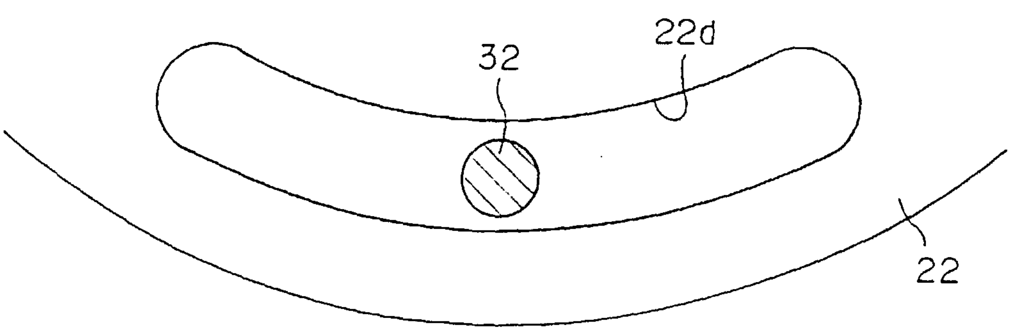


FIG.16B



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 10 0369

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A	EP 0 363 980 A (ROJ ELECTROTEX) 18 April 1990 * abstract; figures 1-6 * ---	1	
A	WO 92 01101 A (IRO) 23 January 1992 * claim 1 * ---	1	
A	EP 0 181 985 A (SULZER) 28 May 1986 * figures 1-6 * ---	2	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 April 1999	Boutelegier, C

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