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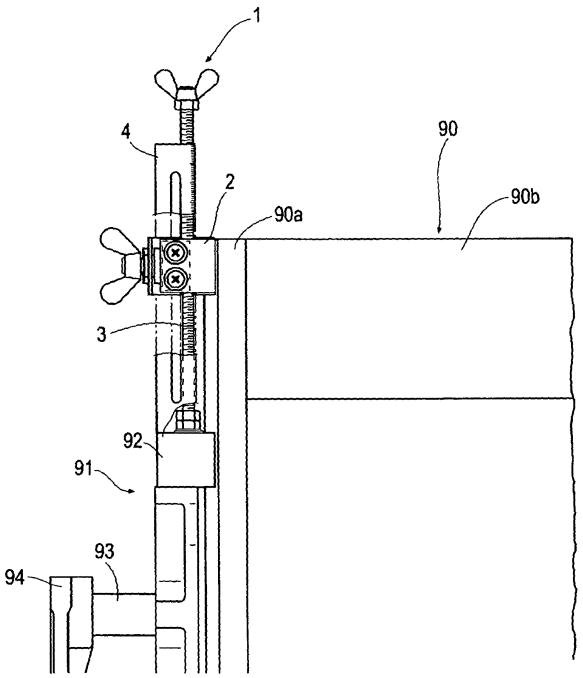
(54) **Heald-frame height adjusting apparatus**

(57) A heald-frame height adjusting apparatus (1) used in a shedding device (80) including a drive transmission mechanism (82) which is provided in accordance with each heald frame (90), which connects a reciprocating driving device (81) and a heald frame (90) with each other, and which is capable of changing a supporting height of the corresponding heald frame (90). The heald-frame height adjusting apparatus (1) includes engaging means (2) and raising-lowering means (3), the engaging means (2) being engageable with and disengageable from the heald frame (90) and being engaged with the heald frame (90) when the height of the heald frame (90) is adjusted before starting an operation of a loom, the raising-lowering means (3) being placed at a securing portion of the loom and moving the engaging means (2) vertically with respect to the securing portion.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an apparatus for adjusting the height of a heald frame of a loom.

2. Description of the Related Art

[0002] When an loom is operated while the height of a heald frame is improperly set, problems, such as shedding failure or tearing of a cloth during a beating-up operation, tend to occur in the loom. Therefore, the height of the heald frame is adjusted so that the beating-up operation is performed at a proper position of a reed.

[0003] For example, in a shedding device of a loom shown in Fig. 9, drive transmission mechanisms are provided in accordance with heald frames. Each drive transmission mechanism converts movement of a reciprocating driving device into vertical movement o>f the corresponding heald frame. The drive transmission mechanisms are provided with portions that support the left and right sides of the heald frames by expansion/contraction rods from therebelow. The overall height of each expansion/contraction rod is changeable. However, each expansion/contraction rod itself is not provided with a height adjusting mechanism. That is, in each expansion/contraction rod, a bolt that maintains the overall height to a predetermined length is only screwed in.

[0004] Therefore, when a bolt is loosened without supporting the corresponding heald frame, the heald frame reduces the overall height of the expansion/contraction rod by its weight, and falls. Therefore, the operation of adjusting the height of each heald frame requires two or more persons, including a person who supports each heald frame and a person who turns each bolt, thereby resulting in poor workability.

[0005] As a related technology that does not require a person who supports a heald frame, a technology in which a heald-frame height adjusting mechanism is included as a portion of a shedding device in a drive transmission mechanism of each heald frame and in which the height adjusting mechanism is manually operated is available (refer to Japanese Unexamined Patent Application Publication Nos. 11-107103 and 05-230734).

[0006] In each of these documents, since a pair of left and right height adjusting mechanisms are used in accordance with the number of heald frames, manufacturing cost of the shedding device is increased. In addition, the height adjusting mechanisms constitute part of the shedding device. Therefore, compared to a shedding device that is not provided with height adjusting mechanisms, the shedding device that is provided height adjusting mechanisms has a large number of parts and has a complicated structure, as a result of which it tends to malfunction.

[0007] Further, a heald frame is heavier in correspondence with the height adjusting mechanisms included in the drive transmission mechanism. Therefore, a structure in which the height adjusting mechanisms are secured to the heald frame is not suitable for increasing the speed of vertical movement of the heald frame.

SUMMARY OF THE INVENTION

[0008] Accordingly, in view of the above-described circumstances, the present invention is achieved. The present invention makes it possible to overcome the above-described problems by providing a heald-frame height adjusting apparatus that easily adjusts the height of a heald frame and that reduces manufacturing costs of a shedding device, and that does not allow the shedding device to easily malfunction and that is suitable for high-speed vertical movement of the heald frame.

[0009] The present invention presupposes a heald-frame height adjusting apparatus used in a shedding device including a drive transmission mechanism which is provided in accordance with each heald frame, which connects a reciprocating driving device and a heald frame with each other, and which is capable of changing a supporting height of the corresponding heald frame.

[0010] In addition, the heald-frame height adjusting apparatus includes engaging means and raising-lowering means, the engaging means being engageable with and disengageable from the heald frame and being engaged with the heald frame when the height of the heald frame is adjusted before starting an operation of a loom, the raising-lowering means being placed at a securing portion of the loom and moving the engaging means vertically with respect to the securing portion. The securing portion of the loom in the present invention refers to an unmoving portion near a side of the heald frame whose height position is fixed with respect to a frame of the loom.

[0011] The engaging means may be one that engages the heald frame from its side surface. However, in order to engage the heald frame and the engaging means with each other without forming the heald frame with a special structure, it is desirable to form the engaging means as follows. That is, the engaging means includes a gripping device that grips any location of the heald frame.

[0012] The raising-lowering means may include a driving device serving as a power source. However, in order to reduce manufacturing cost thereof, it is desirable to form the raising-lowering means in the following way. That is, the raising-lowering means includes a threaded member, an operating section, and a seat, the threaded member having either one of an externally threaded portion or an internally threaded portion, the one of the threaded portions of the threaded member being screwed to the other of the threaded portions formed in the engaging means, the operating section rotating the one of the threaded portions of the threaded member and the other of the threaded portions of the engaging means relative to each other, the seat being placed at the se-

curing portion of the loom.

[0013] The heald-frame height adjusting apparatus may only include the engaging means and the raising-lowering means. However, in order to further increase the efficiency with which the height of the heald frame is adjusted, it is desirable that the heald-frame height adjusting apparatus be formed as follows. That is, the heald-frame height adjusting apparatus further comprises heald-frame height measuring means for measuring the height of the heald frame.

[0014] According to the present invention, the heald-frame height adjusting apparatus includes engaging means, engageable with the heald frame, and raising-lowering means, placed at the securing portion of the loom. Therefore, the heald-frame height adjusting apparatus can be used so that it is mounted only prior to starting the operation of the loom and so that it is removed when the loom is operating. Consequently, if there are at least two heald-frame height adjusting apparatuses according to the present invention that are mounted to the left and right sides of each heald frame, respectively, the height of each heald frame of the entire loom can be adjusted by repeatedly adjusting the height of each heald frame. As a result, manufacturing cost of a shedding device is reduced.

[0015] The heald-frame height adjusting apparatus according to the present invention is independent of the reciprocating driving device and the drive transmission mechanism of the shedding device, and can be removed when the loom is operating. Therefore, the heald-frame height adjusting apparatus is suitable for high-speed vertical movement of the heald frame and does not easily allow malfunctioning of the shedding device.

[0016] Moreover, according to the present invention, if the raising-lowering means is used after mounting the raising-lowering means between the heald frame and the securing portion of the heald frame, it is possible to vertically move the engaging means and to allow the whole engaging means to vertically move the heald frame. This makes it possible to change the supporting height of the heald frame by the drive transmission mechanism. Therefore, the height of the heald frame can be easily adjusted.

[0017] If the engaging means includes a gripping device that grips any position of the heald frame, the heald frame does not require a special structure for engaging the heald frame and the engaging means with each other. Therefore, the vertical movement of the heald frame caused by the shedding device is not affected at all.

[0018] The following is true when the raising-lowering means includes a threaded member, an operating section, and a seat, the threaded member having either one of an externally threaded portion or an internally threaded portion, the one of the threaded portions of the threaded member being screwed to the other of the threaded portions formed in the engaging means, the operating section rotating the one of the threaded portions of the threaded member and the other of the threaded portions of the engaging means relative to each other, the seat being placed at the securing portion of the loom. That is, manufacturing cost of the raising-lowering means according to the present invention can be kept lower than manufacturing cost of the raising-lowering means including a driving device.

[0019] If the heald-frame height adjusting apparatus includes heald-frame height measuring means for measuring the height of the heald frame, a separate heald-frame height measuring means does not need to be provided. Therefore, the height of the heald frame can be more easily adjusted.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig. 1 is a front view showing a state of use of a heald-frame height adjusting apparatus according to a first embodiment of the present invention;

Fig. 2 is a front view showing the heald-frame height adjusting apparatus according to the first embodiment of the present invention;

Fig. 3 is a left side view of Fig. 2;

Fig. 4 is a enlarged sectional view taken along line IV-IV shown in Fig. 2;

Fig. 5 is a front view showing a state of use of a heald-frame height adjusting apparatus according to a second embodiment of the present invention;

Fig. 6A is a front view of the heald-frame height adjusting apparatus according to the second embodiment of the present invention;

Fig. 6B is an enlarged sectional view taken along line VIB-VIB shown in Fig. 6A;

Fig. 7 is a front view showing a state of use of a heald-frame height adjusting apparatus according to a third embodiment of the present invention;

Figs. 8A and 8B are, respectively, a front view and a side view of the heald-frame height adjusting apparatus according to the third embodiment of the present invention;

Fig. 9 is a front view of a shedding device that raises and lowers a heald frame;

Fig. 10 is a perspective view of a structure that guides the left side of the heald frame;

Fig. 11 is a front view of a structure in which the shedding device supports the heald frame from therebelow; and

Fig. 12 is a side view showing the relationship between the height of a frame, the height of a heald frame guide, and the height of the heald frame.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] An exemplary loom to which a heald-frame height adjusting apparatus 1 is applied is described with reference to Figs. 9 to 11. Fig. 9 shows a structure that raises and lowers a heald frame 90. Fig. 10 shows a

structure that guides the left side of the heald frame 90. Fig. 11 shows a structure in which a shedding device 80 supports the heald frame 90 from therebelow.

[0022] The exemplary loom to which the heald-frame height adjusting apparatus 1 is applied includes guides 91, provided at left and right sides of the heald frame 90, respectively. In the exemplary loom, the guides 91 guide a front-back direction and a left-right direction of the heald frame 90 that is caused to move vertically, and the shedding device 80 (provided below the heald frame 90) moves the heald frame 90 vertically. The shedding device 80 and the guides 91 will hereunder be described in more detail in this order.

[0023] The shedding device 80 includes a reciprocating driving device 81 and a drive transmission mechanism 82 provided in accordance with each heald frame 90. The drive transmission mechanism 82 converts reciprocating movement of the reciprocating driving device 81 into raising-lowering movement of the heald frame 90.

[0024] First, in the drive transmission mechanism 82, reciprocating movement of a swinging lever 83 (which is a portion of the reciprocating driving device 81) is transmitted to one of left and right swinging arms 85 and 85 (supported at the same height) through a connecting lever 84. The drive transmission mechanism 82 causes the left and right swinging arms 85 and 85 to be set in synchronism by a link 86 and to swing. Then, in the drive transmission mechanism 82, the left and right swinging arms 85 and 85 change the swinging movements to vertical movements of expansion/contraction rods 87, and the expansion/contraction rods 87 transmit the vertical movements to the lower left and right sides of the heald frame 90, so that the heald frame 90 is finally caused to move vertically. Each portion will hereunder be described in detail.

[0025] The pair of swinging arms 85 and 85 are swingably supported around respective left and right points P below the heald frame 90. One swinging end of one of the swinging arms 85 is connected to one swinging end of the other swinging arm 85 through the link 86, and the other swinging ends of the swing arms 85 and 85 are connected to the respective expansion/contraction rods 87. The connecting lever 84 is connected to one of the swinging arms 85.

[0026] Each expansion/contraction rod 87 can change a supporting height of the heald frame 90. In each expansion/contraction rod 87, a joint rod 87b is inserted into a vertically extending cylindrical belt frame joint 87a so as to be slidably vertically, and a bolt 87c is screwed into the belt frame joint 87a to secure the joint rod 87b, so that an upward-direction projection length of the joint rod 87b from the belt frame joint 87a is maintained. In each expansion/contraction rod 87, the bolt 87c is loosened as required to change the upward-direction projection length of the joint rod 87b from the belt frame joint 87a. When the upward-direction projection length of the joint rod 87b from the heald frame joint 87a is adjusted, the height of the heald frame 90 is changed.

[0027] When the other swinging end of each swinging arm 85 is connected to the lower end of its corresponding belt frame joint 87a, each swinging arm 85 converts the swinging movement into the vertical movement. When the lower portion of the heald frame 90 is connected to the upper end of each joint rod 87b through a joint 87d, the heald frame 90 moves in the vertical direction together with each expansion/contraction rod 87.

[0028] In the guides 91, heald frame guides 92 are disposed on sides of side stays 90a and 90a constituting the left and right portions of the heald frame 90, and are provided with grooves 92a. These grooves 92a open inwardly at the left and right sides, and are spaced apart from each other in the front-back direction and the vertical direction. The front and back and the left and right outer sides of the side stays 90a are guided to the grooves 92a. In the guides 91, guide shafts 93 protrude outwards towards the left and right from the heald frame guides 92, and the left and right outer sides of the guide shafts 93 are supported by a frame 95 of the loom through shaft brackets 94.

[0029] Of a pair of left and right heald-frame height adjusting apparatuses 1 and 1 according to a first embodiment used in the above-described loom, only the left heald-frame height adjusting apparatus 1 will be described with reference to Figs. 1 to 4. Fig. 1 is a front view of a structure that supports the heald frame 90 by placing the heald-frame height adjusting apparatus 1 on the heald frame guide 92. Fig. 2 is an enlarged front view of the heald-frame height adjusting apparatus 1. Fig. 3 is a left side view of Fig. 2. Fig. 4 is a sectional view taken along line IV-IV shown in Fig. 2.

[0030] When a height adjustment operation of the heald frame 90 performed before starting the operation of the loom is to be performed, the heald-frame height adjusting apparatus 1 shown in Figs. 1 to 3 is placed on the heald frame guide 92 serving as a securing portion of the loom, and is mounted to and set at the heald frame 90. The heald-frame height adjusting apparatus 1 is moved vertically while supporting the heald frame 90 after setting the heald-frame height adjusting apparatus 1, to adjust the height of the heald frame 90. After adjusting the height of the heald frame 90, the heald-frame height adjusting apparatus 1 is removed from the loom. Therefore, the heald-frame height adjusting apparatus 1 does not influence the operation of the shedding device 80 when the loom is in operation.

[0031] The heald-frame height adjusting apparatus 1 includes engaging means 2 that engages the heald frame 90, raising-lowering means 3 that moves the engaging means 2 in the vertical direction, and heald-frame height measuring means 4 that measures the height of the heald frame 90. Each means will be described in detail below.

[0032] The engaging means 2 can be engaged with and disengaged from the heald frame 90, and supports the heald frame 90 when the height of the heald frame 90 is adjusted. Although, in the relevant figures, the entire engaging means 2 is integrally assembled to the raising-

lowering means 3, it is possible to integrally assemble a portion of the engaging means 2 to the raising-lowering means 3 and to form the remaining portion of the engaging means 2 separately from the raising-lowering means 3, so that these two portions are used in combination when adjusting the height of the heald frame 90. Although the location where the heald frame 90 is supported is the left side stay 90a of the heald frame 90 in Fig. 1, it may be an upper frame 90b of the heald frame 90. Although the form of engagement with respect to the heald frame 90 is gripping in the relevant figures, other forms of engagement may be used as long as the heald frame 90 can be supported.

[0033] The illustrated engaging means 2 is a gripping device that grips the front and back sides of the side stay 90a. That is, the engaging means 2 grips the side stay 90a between a body 5 and a clamping member 6 by a fastening section 7. The body 5, the clamping member 6, and the fastening section 7 will be described in detail in this order below.

[0034] The body 5 includes a rectangular parallelepiped body block 51, disposed at an outer side in the left-right direction of the side stay 90a, and a clamping section 52, which protrudes from a front portion of an inner surface (facing the heald frame 90) in the left-right direction of the body block 51 and which is disposed at a front surface of the side stay 90a.

[0035] The body block 51 has a vertically extending through hole 53, with an internally threaded portion 54 that engages the raising-lowering means 3 being formed in the inner peripheral surface of the through hole 53. The body block 51 is also provided with a stepped portion 55 so that, at the back side, its left-right direction outer side protrudes rearwards than its left-right direction inner side. Further, an external thread 71 of the fastening section 7 protrudes sideways and outwards from the left-right direction outer surface of the body block 51. More specifically, the direction of projection of the external thread 71 is perpendicular to the direction in which the through hole 53 extends through the body block 51 and to a gripping direction.

[0036] The clamping member 6 is a substantially L-shaped plate member, with one portion 61 being disposed at the left-right direction outer side of the body block 51 and another portion 62 extending to the clamping section 52 from the left-right direction outer side of the body block 51. The one portion 61 has a hole 61a extending through the external thread 71 of the fastening section 7. The another portion 62 has a stepped portion whose uneven portion follows the stepped portion 55 of the body block 51, with its left-right direction inner portion serving as a clamping section 63 facing the clamping section 52 at the body block 51.

[0037] In the fastening section 7, a hole 72a of a tapered washer 72, the hole 61a of the one portion 61 of the clamping section 6, and a hole 73a of a tapered washer 73 are successively inserted onto the external thread 71, and, then, a butterfly nut is screwed thereto. The back side tapered washer 72 is secured to the left-right direction outer surface of the body block 51, and the butterfly-nut-side tapered washer 73 is secured to the left-right direction outer surface of the one portion 61 of the clamping member 6.

[0038] A left-right direction outer surface of the rear-side tapered washer 72 is provided with a inclined surface that extends from its front side to its back side and gradually towards the heald frame 90. A left-right direction outer surface of the butterfly-nut-side tapered washer 73 is provided with an inclined surface extending in a direction that is opposite to that of the rear-side tapered washer 72. Therefore, when a butter-fly nut 74 is tightened, the clamping section 63 of the clamping member 6 is inclined in the front-back direction in accordance with angles of the inclined surfaces from its parallel state with respect to the clamping section 52 of the body 5. This causes an opening formed by the pair of clamping sections 52 and 63 to be further narrowed at an entrance side thereof, so that a force of gripping the heald frame 90 is further increased.

[0039] To maintain the inclination of the clamping member 63, the hole 73a of the butterfly-nut-side tapered washer 73 and the hole 61a of the clamping member 6 are provided with a play with respect to the external thread 71. Anti-slippage frictional members 52a and 63a are secured to opposing clamping surfaces of the clamping sections 52 and 63.

[0040] The raising-lowering means 3 that is described next is placed at the securing portion of the loom, and moves the engaging means 2 vertically with respect to the securing portion.

[0041] In the illustrated raising-lowering means 3, a threaded member 31 that engages the engaging means 2 is a main body, and a rotatable seat 32 provided at the lower end of the threaded member 31 is placed on the upper surface of the belt frame guide 92. By operating an operating section 33 provided at the upper end of the threaded member 31, the threaded member 31 is caused to be rotated or to be reversely rotated relative to the engaging means 2, so that the engaging means 2 is raised or lowered in accordance with each heald frame 90.

[0042] The threaded member 31 uses a stud bolt at a shaft where an external thread 31a is provided over at least a range in which the engaging means 2 is raised or lowered. The stud bolt has threads over the entire length of the shaft in the relevant figures.

[0043] A nut 34 and a conical spring nut 35 are disposed adjacent to each other in the up-down direction at, and are screwed to the lower end of the threaded member 31. When the two nuts function, the position of the conical spring nut 35 is fixed. A conical spring 35a of the conical spring nut 35 is positioned below the lower end surface of the stud bolt 31, is rotatably held with respect to the stud bolt 31, and becomes the seat 32.

[0044] In the relevant figures, the seat 32 is placed on the upper surface of the belt frame guide 92, but the

present invention is not limited thereto. The seat 32 may be placed on the upper surface of the frame 95 of the loom, or may be placed on the upper surface of a component part other than the frame 95 that is secured to the frame 95. That is, the seat 32 is placed on a portion of the securing portion of the loom whose height does not change with respect to the upper surface of the frame 95 of the loom.

[0045] A butterfly nut 36, provided separately from that of the engaging means 2, and a different nut 37 are disposed adjacent to each other in the up-down direction, and are screwed to the upper end of the threaded member 31. Similarly, the position of the butterfly nut 36 is fixed. The butterfly nut 36 becomes the operating section 33.

[0046] The heald-frame height measuring means 4, which is described next, measures the height of a particular location of the heald frame 90 with respect to a reference location, and allows an operator to determine the supporting height of the heald frame 90 on the basis of the result of measurement. In the relevant figures, the reference location is the upper surface of the heald frame guide 92, and the particular location of the heald frame 90 is the upper surface of the body block 51 which is flush with the upper surface of the heald frame 90.

[0047] The illustrated heald-frame height measuring means 4 supports a scale 41 so as to be movable vertically relative to the body 5 of the engaging means 2. The operator places the scale 41 on the upper surface of the heald frame guide 92, moves the engaging means 2 together with the heald frame 90 vertically with respect to the scale 41, and compares the scale 41 at this time with the position indicated by the upper surface of the body 5, to measure the supporting height of the heald frame 90.

[0048] The scale 41 includes an elongated square-shaped board that is calibrated vertically. An elongated hole 42 is formed vertically in an intermediate portion (formed with respect to the left and right sides of the calibrated board) so as to extend therethrough in the front-back direction.

The scale 41 is disposed at the front surface of the body 5 through a base 43. Washers 45 and pan head machine screws 44 are successively disposed at the front surface side of the scale 41. A threaded shaft of each pan head machine screw 44 is passed through a hole 43a of the base 43, a hole 45a of the washer 45, and an elongated hole 42 of the scale 41, and is screwed to a threaded hole 56 in the front surface of the body 5, so that the scale 41 is supported by the body 5. The operator adjusts a screwing depth of each pan head machine screw 44 with respect to the threaded hole 56 of the body 5 so that a gap can be formed between the base 43 and the scale 41. As a result, the engaging means 2 can be held so as to be movable vertically with respect to the scale 41 placed at the upper surface of the heald frame guide 92.

[0049] The above-described illustrated heald-frame height adjusting apparatus 1 is used by the following procedures. First, the loom is moved slightly and is stopped so that the heald frame 90 is set to a predetermined height. Next, prior to setting the pair of left and right heald-frame height adjusting apparatuses 1 to the loom, the butterfly nut 74 of the gripping device 2 is previously loosened, so that the interval between the pair of clamping surfaces of the gripping device 2 is wider than the thickness of the side stay 90a. The operator previously adjusts the butterfly nut 36 of the operating section 33 so that the distance between the upper surface of the body 5 of the gripping device 2 and the bottom surface of the conical spring nut 35 is less than the distance between the upper surface of the heald frame 90 and the upper surface of the heald frame guide 92.

[0050] While the operator adjusts the height of the body 5 and the heald frame 90 to be adjusted so that the upper surface of the heald frame 90 and the upper surface of the body 5 are flush with each other, each heald-frame height adjusting apparatus 1 is pushed towards the corresponding side stay 90a, and a side surface of each side stay 90a is brought into contact with the bottom of the opening formed by the pair of clamping surfaces of the gripping device 2, and the threaded member 31 of the raising-lowering means 3 is set perpendicularly. Here, by tightening the butterfly nut 74 of the gripping device 2, each side stay 90a is gripped by the pair of clamping surfaces.

[0051] Next, using the operating section 33 of the raising-lowering means 3, the operator causes the threaded member 31 and the internally threaded portion 54 of the body 5 to rotate relative to each other and causes the conical spring nut 35 to come into contact with the upper surface of the belt frame guide 92. At this time, the scale 41 falls due to its own weight, so that its lower end contacts the upper surface of the heald frame guide 92.

[0052] Next, the operator loosens the bolt 87c of each of the left and right heald frame joints 87a supporting the heald frame 90 from therebelow, so that the projection length of each joint rod 87b with respect to its corresponding belt frame joint 87a is in a changeable state. At this time, since the left and right sides of the heald frame 90 are supported by the left and right heald-frame height adjusting apparatuses 1 and 1, the heald frame 90 does not fall due to its own weight. Thereafter, the operator turns the butterfly nut 36 (which corresponds to the operating section 33 of the raising-lowering means 3), to vertically move the gripping device 2 together with the heald frame 90, to adjust the heald frame 90 to a predetermined height while watching the location at which the upper surface of the body 5 (serving as an indicator) matches a division mark on the scale 41.

[0053] The method of adjusting a specific height position will be described with reference to Fig. 12. The height adjustment is determined on the basis of a height H1 from the upper surface of the heald frame guide 92 to the upper surface of the heald frame 90. A belt (not shown) is supported at the heald frame 90. The height of the heald frame 90 is adjusted so that the center of a mail in the heald is at a predetermined length with respect

to the upper surface of the frame 95. Here, in addition to the aforementioned height H1, a height H2 from the upper surface of the frame 95 to the upper surface of the heald frame guide 92 is considered.

[0054] After adjusting the height position, the bolt 87c of each of the left and right belt frame joints 87a is loosened, to fix the projection length of each joint rod 87b. Each belt frame joint 87a and each joint rod 87b are connected to each other, to fix the supporting height of the heald frame 90.

[0055] Thereafter, the butterfly nut 74 of the gripping device 2 of each of the heald-frame height adjusting apparatuses 1 is loosened, to ungrip the heald frame 90, so that each of the heald-frame height adjusting apparatus 1 is removed from the loom. These operations are repeated for the number of heald frames 90 to be adjusted.

[0056] Next, a heald-frame height adjusting apparatus according to another embodiment shown in Figs. 5 and 6 will be described. Fig. 5 is a front view of a structure in which the heald-frame height adjusting apparatus 1 is placed on a heald frame guide 92, and supports the heald frame 90. Fig. 6A is an enlarged front view of the heald-frame height adjusting apparatus 1. Fig. 6B is an enlarged sectional view taken along line VIB-VIB shown in Fig. 6B.

[0057] The structure and the operation of the illustrated heald-frame height adjusting apparatus 1 are basically the same as those of the heald-frame height adjusting apparatus 1 according to the previous embodiment. It differs from the heald-frame height adjusting apparatus 1 according to the previous embodiment in that engaging means 2 and the heald frame 90 are made to engage each other by a pin connection, and in that heald-frame height measuring means 4 is built into raising-lowering means 3. Therefore, the heald-frame height adjusting apparatus 1 is not provided with dedicated heald-frame height measuring means 4.

[0058] The engaging means 2 is an engaging device that engages with a left-right direction outer surface of the heald frame 90. The engaging device 2 includes a body 5 that is vertically moved by the raising-lowering means 3, and an engaging pin 57 that protrudes from a left-right direction inner surface of the body 5 towards a side stay 90a of the heald frame 90.

[0059] Like the body 5 in the previous embodiment, the body 5 has a rectangular parallelepiped shape, and includes a vertically extending through hole 53, with an internally threaded portion 54 being formed in the through hole 53. Unlike the body 5 in the previous embodiment, the body 5 has a hole 58 to which one side of the engaging pin 57 is press-fitted. The engaging pin 57, properly speaking, an engaging hole 59 to which the other side of the engaging pin 57 is fitted is formed in an outwardly facing side surface of the side stay 90a. The height at which the engaging hole 59 is formed is determined so that the upper surface of the heald frame 90 and the upper surface of the body 5 become flush with each other as in the previous embodiment. The engaging hole 59 may be additionally formed in an already provided heald frame 90 or may be previously formed in a newly provided heald frame 90.

[0060] The raising-lowering means 3 is provided at the vertically extending heald-frame height measuring means 4 at a shaft portion of a threaded member 31 thereof. In the heald-frame height measuring means 4, a vertically extending calibrated display surface 46 is provided at the shaft portion of the threaded member 31. Division marks of the calibrated display surface 46 are vertically spaced apart from each other. In the illustrated embodiment, in the heald-frame height measuring means 4, a portion of the entire area in the circumferential direction of a stud bolt (which corresponds to the threaded member 31) is cut vertically to form threads on this portion, so that the calibrated display surface 46 is formed. Linear division marks that extend at right angles to an axial direction of the shaft portion are formed vertically at the calibrated display surface 46 which has become substantially flat. Therefore, the cross section of the threaded member 31 has a form in which a portion of a circle is cut straight in plan view.

[0061] Next, a heald-frame height adjusting apparatus 1 according to still another embodiment shown in Figs. 7 and 8 will be described. Fig. 7 is a front view of a structure in which the heald-frame height adjusting apparatus 1 is placed on a heald frame guide 92 and supports the heald frame 90. Fig. 8A is an enlarged front view of the heald-frame height adjusting apparatus 1. Fig. 8B is a left side view of Fig. 8B.

[0062] Unlike the heald-frame height adjusting apparatuses 1 according to the previous embodiments in which a plurality of members are combined into an integral structure for use, the illustrated heald-frame height adjusting apparatus 1 is formed so that engaging means 2 is divided into two portions having different functions, and so that only one of the portions of the engaging means 2 is built in the raising-lowering means 3.

[0063] More specifically, the illustrated engaging means 2 is an engaging device in which a first engaging section 21 engageable with the heald frame 90 and a second engaging section 22 that is raised and lowered by a threaded member 31 of the raising-lowering means 3 are separately provided. The engaging device is such that the first engaging section 21 is placed on the second engaging section 22 for use when the height of the heald frame 90 is adjusted.

[0064] The first engaging section 21 has the same structure as the engaging devices according to the previous embodiments except that it does not have a through hole 53 and an internally threaded portion 54. The first engaging section 21 includes a body 5 and an engaging pin 57.

[0065] The second engaging section 22, along with a substantially C-shaped supporting member 23 (on which the first engaging section 21 is placed), is provided to allow a shaft portion of an upper bolt 24 to extend downward from the bottom surface of the supporting member

23. The shaft portion of the upper bolt 24 is screwed into a turn buckle 38 of the raising-lowering means 3 (described later).

[0066] An opening direction of a C-shaped plate of the supporting member 23 faces upward. A front portion 23b and a rear portion 23c, provided at the front and rear of a central portion 23a, are disposed at the front and rear of the body 5, so that the body 5 moving in the front-back direction does not fall. The supporting member 23 has a through hole 23d extending vertically in the central portion 23a of the supporting member 23. The shaft portion of the upper bolt 24 is inserted downward into the through hole 23d. The central portion 23a is interposed between a head of a nut 25, screwed to the shaft portion, and a head of the upper bolt 24, extending downward from the supporting member 23, to secure the supporting member 23. The upper surface of the head of the upper bolt 24 becomes the location where the bottom surface of the first engaging section 21 (body 5) is placed.

[0067] A nut 26, a scale 41, and a washer 45 are disposed in front of the front portion 23b of the supporting member 23, and these are stopped at the front portion 23b by a pan head machine screw 44. A play is provided between the scale 41 and the nut 26 so that the scale 41 can be moved vertically.

[0068] The illustrated raising-lowering means 3 is integrally combined with the second engaging section 22. The turn buckle 38 screwed to the upper bolt 24 at the second engaging section 2 is made to correspond to an operating section 33, a lower bolt screwed to the lower end of the turn buckle 38 is made to correspond to the vertically extending threaded member 31, and a head of the lower bolt 31 is made to correspond to a seat 32.

[0069] As usual, the turn buckle 38 is provided with a right-handed screw at one end and a left-handed screw at the other end, so that externally threaded portions of the upper bolt 24 and the lower bolt 31 are reverse screws.

[0070] The illustrated heald-frame height adjusting apparatus 1 is used considering that the first engaging section 21 is a separate section. That is, an operator engages the first engaging sections 21 to the left and right sides of the heald frame 90, and, then, each second engaging section 22, each raising-lowering means 3, and each heald-frame height measuring means 4 that are integrated to each other are disposed between the corresponding first engaging section 21 and the corresponding heald frame guide 92. At this time, the operator can fit each supporting member 23 at the second engaging section 22 to the lower portion of its corresponding first engaging section 21, and position the front-back directions of the first and second engaging sections 21 and 22. Thereafter, each turn buckle 38 is turned, and the bottom surface of each lower bolt 31 is brought into contact with the upper surface of the corresponding heald frame guide 92, to support the heald frame 90. The subsequent operations are the same as those in the other embodiments.

[0071] Although the illustrated second engaging section 22 is described as being a portion of the engaging means 2 in the foregoing description, it may be described as being a portion of the raising-lowering means 3. In this case, the raising-lowering means 3 includes an internally threaded portion of the turn buckle 38 (serving as the threaded member 31 screwed to the upper bolt 24 at the second engaging section 22 and extending vertically), the turn buckle 38 serving as an operating section for rotating the internally threaded portion of the turn buckle 38 and the upper bolt 24 at the second engaging section 22 relative to each other, and the lower bolt 31 serving as a seat on which the securing portion of the loom is placed.

[0072] The heald-frame height adjusting apparatus 1 is not limited to the above-described embodiments. In the first embodiment, the direction of projection of the external thread 71 of the fastening section 7 is perpendicular to the direction in which the through hole 53 extends through the body 5 in the gripping device 2 and to a gripping direction. However, the present invention is not limited thereto. The projection direction may be parallel to the gripping direction, or may be parallel to the axial direction of the shaft of the internally threaded portion 54 of the body 5.

[0073] In the second embodiment, the engaging pin 57 is formed integrally with the body 5, and the engaging hole 59 is formed in the side stay 90a. However, the present invention is not limited thereto. It is possible to integrate the engaging pin 57 to the side stay 90a and to form the engaging hole 59 in the body 5, or it is possible to form engaging holes in the body 5 and the side stay 90a, respectively, and use the engaging pin 57 as a single member.

[0074] In the second embodiment, in the heald-frame height measuring means 4, the upper surface of the body 5 that is made flush with the upper surface of the heald frame 90 serves as an indicator, and the operator reads a scale value that matches the indicator and adjusts the height of the heald frame 90. However, the present invention is not limited thereto. A dedicated indicator may be provided at a location that does not match the upper surface of the heald frame 90. For example, although not illustrated, in the heald-frame height measuring means 4, it is possible to use, as the threaded member 31, an ordinary stud bolt having threads at both ends over the entire length and not having threads at portions of the entire length; to form the surface not having threads as the calibrated display surface 46; to move the body 5 at the externally threaded section 31a below or above the calibrated display surface 46; and to protrude a dedicated indicator from the body 5 towards the calibrated display surface 46 at the upper side or the lower side.

[0075] In the last embodiment, the first engaging section 21 that is separate from the heald frame 90 engages the heald frame 90. However, the present invention is not limited thereto. The heald frame 90 itself may integrally include the first engaging section 21 as a portion thereof. In this case, the first engaging section 21 is not

included in the heald-frame height adjusting apparatus 1, and the engaging means 2 only includes the second engaging section 22.

[0076] In the last embodiment, the turn buckle 38 and the lower bolt 31 are combined so that the length of the raising-lowering means 3 is changed. However, instead, it is possible to simply provide a rotatably supporting shaft in place of the lower bolt 31; to provide in place of the turn buckle 38 a nut member that rotatably supports the upper portion of the supporting shaft at the lower side; to screw the upper bolt 24 at the second engaging section 22 to an internal thread at the upper side of the nut member; and to use the upper bolt 24 as the threaded member 31. Alternatively, it is possible to simply provide a supporting shaft extending downward from the C-shaped supporting member 23 in place of the upper bolt 24; to provide a nut member that rotatably supports the lower portion of the supporting shaft at the upper side in place of the turn buckle 38; and to screw the lower bolt 31 to an internal thread at the lower side of the nut member. Still alternatively, in place of the turn buckle 38, the upper bolt 24, and the lower bolt 31, it is possible to use a turn buckle rod having reverse external threads at both ends thereof, and nut members that engage the external threads.

Claims

1. A heald-frame height adjusting apparatus (1) used in a shedding device (80) comprising a drive transmission mechanism (82) which is provided in accordance with each heald frame (90), which connects a reciprocating driving device (81) and a heald frame (90) with each other, and which is capable of changing a supporting height of the corresponding heald frame (90),
wherein the heald-frame height adjusting apparatus (1) is **characterized by** comprising engaging means (2) and raising-lowering means (3), the engaging means (2) being engageable with and disengageable from the heald frame (90) and being engaged with the heald frame (90) when the height of the heald frame (90) is adjusted before starting an operation of a loom, the raising-lowering means (3) being placed at a securing portion of the loom and moving the engaging means (2) vertically with respect to the securing portion.

2. The heald-frame height adjusting apparatus (1) according to Claim 1, wherein the engaging means (2) includes a gripping device that grips any location of the heald frame (90).

3. The heald-frame height adjusting apparatus (1) according to either Claim 1 or Claim 2, wherein the raising-lowering means (3) includes a threaded member (31), an operating section (33), and a seat (32), the threaded member (31) having either one of an externally threaded portion or an internally threaded portion, the one of the threaded portions of the threaded member (31) being screwed to the other of the threaded portions formed in the engaging means (2), the operating section (33) rotating the one of the threaded portions of the threaded member (31) and the other of the threaded portions of the engaging means (2) relative to each other, the seat (32) being placed at the securing portion of the loom.

4. The heald-frame height adjusting apparatus (1) according to any one of Claims 1 to 3, further comprising heald-frame height measuring means (4) for measuring the height of the heald frame (90).

FIG. 1

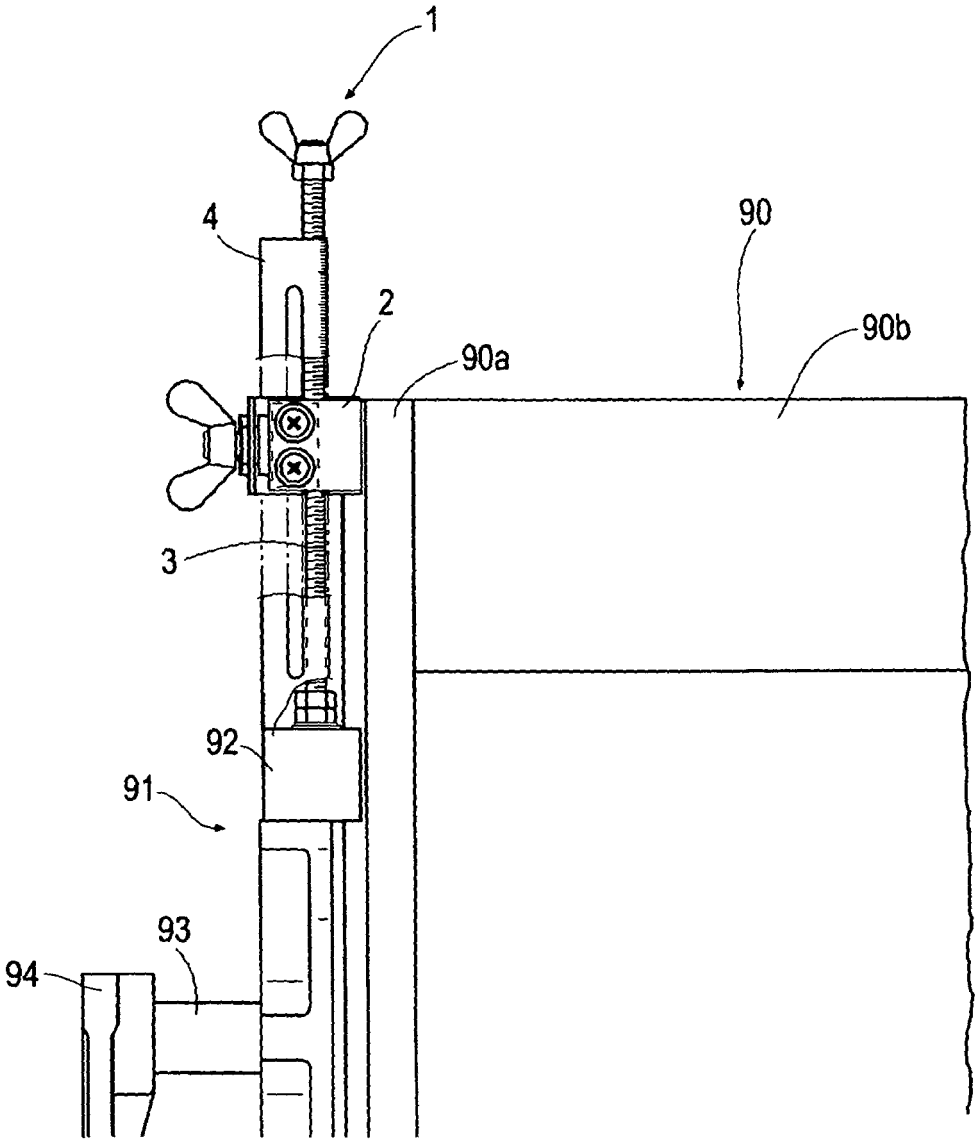
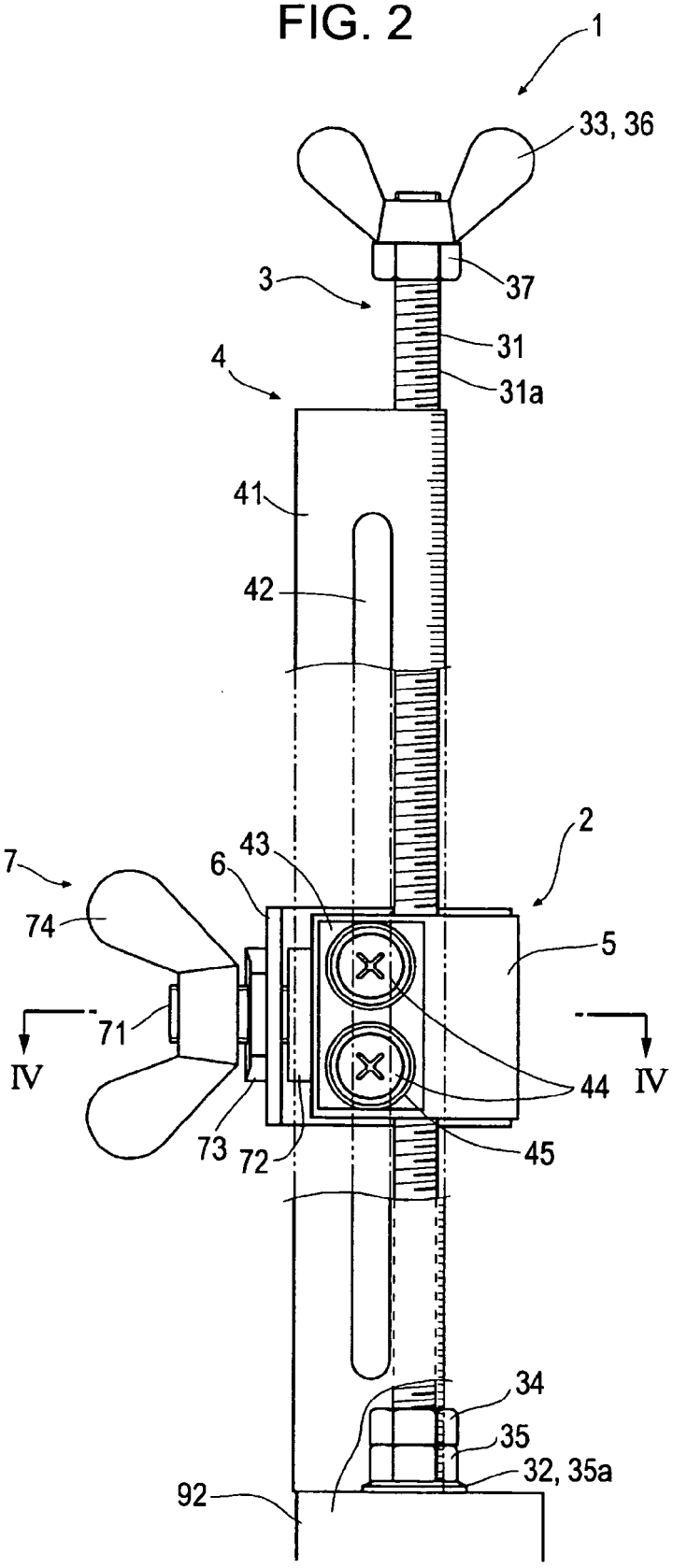


FIG. 2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IV
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92

FIG. 3

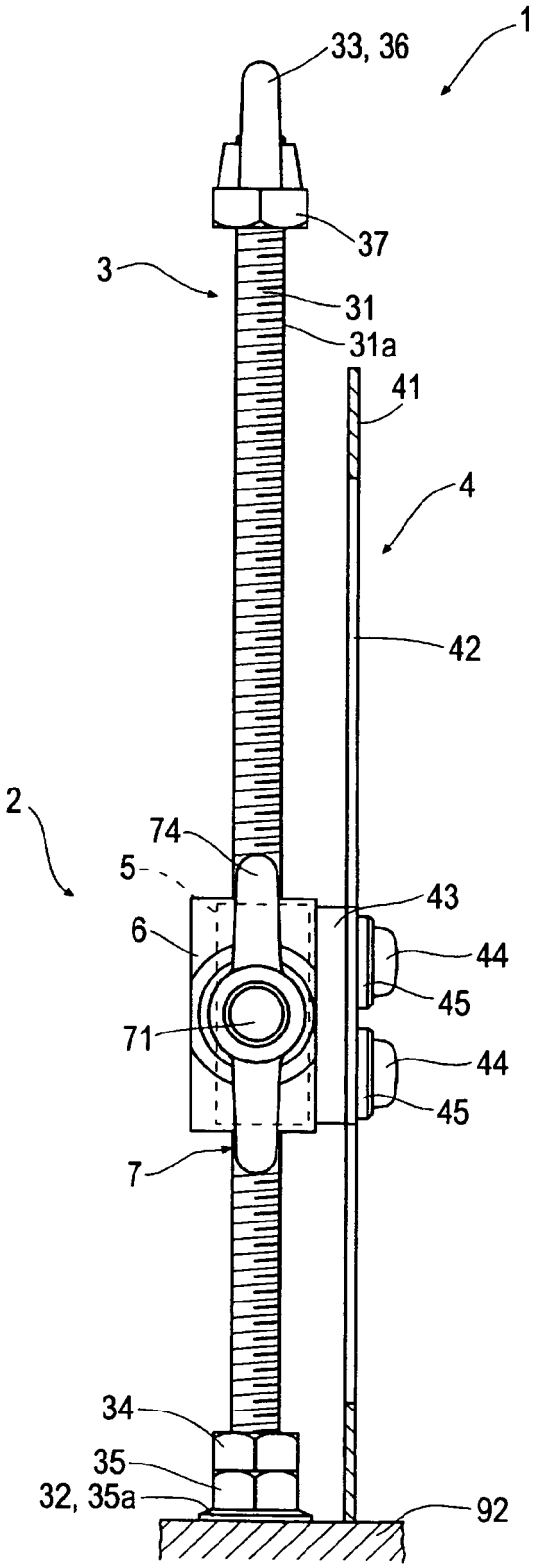
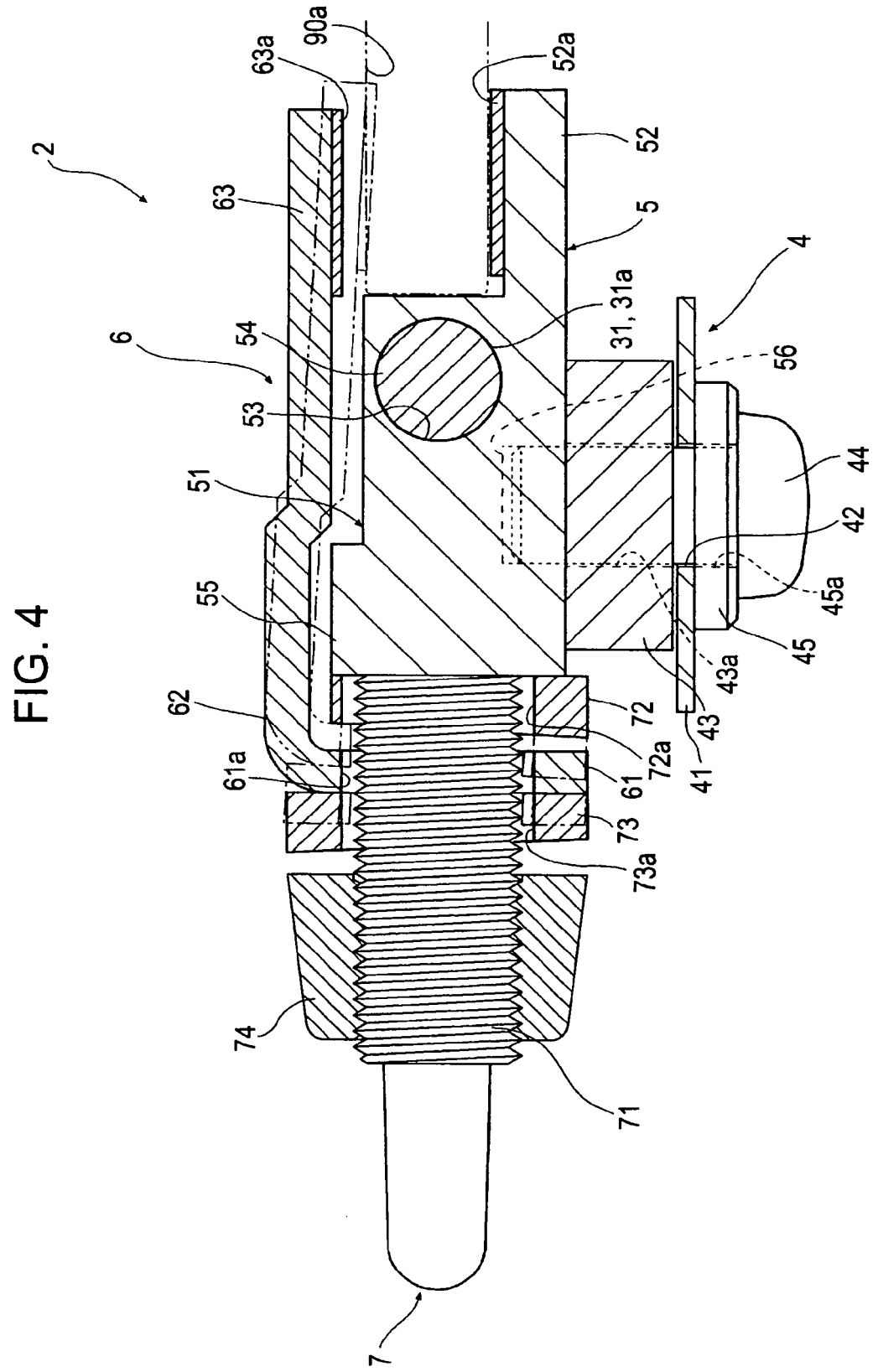


FIG. 4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54
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7

FIG. 5

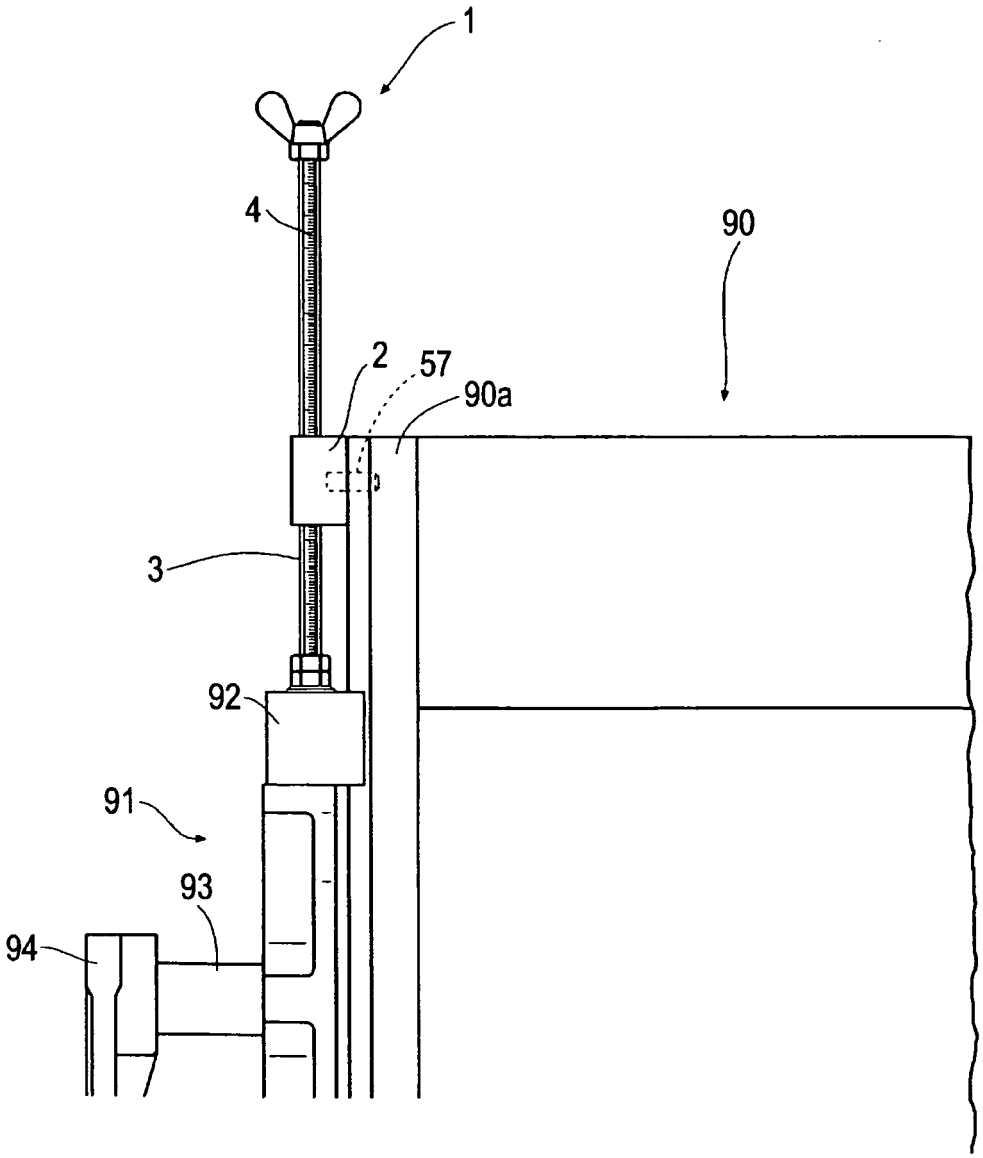
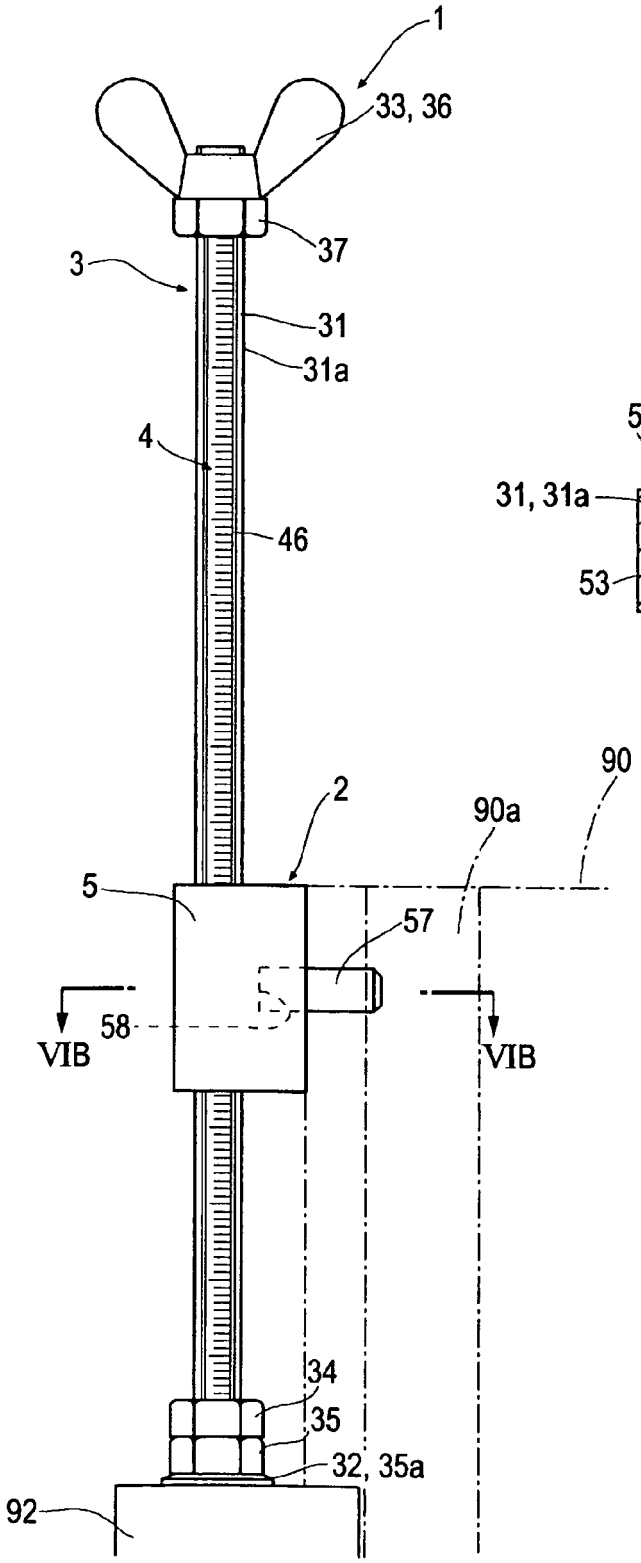


FIG. 6A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3
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VIB
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FIG. 6B

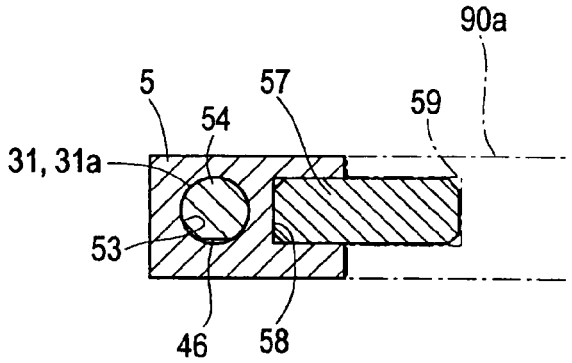
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FIG. 7

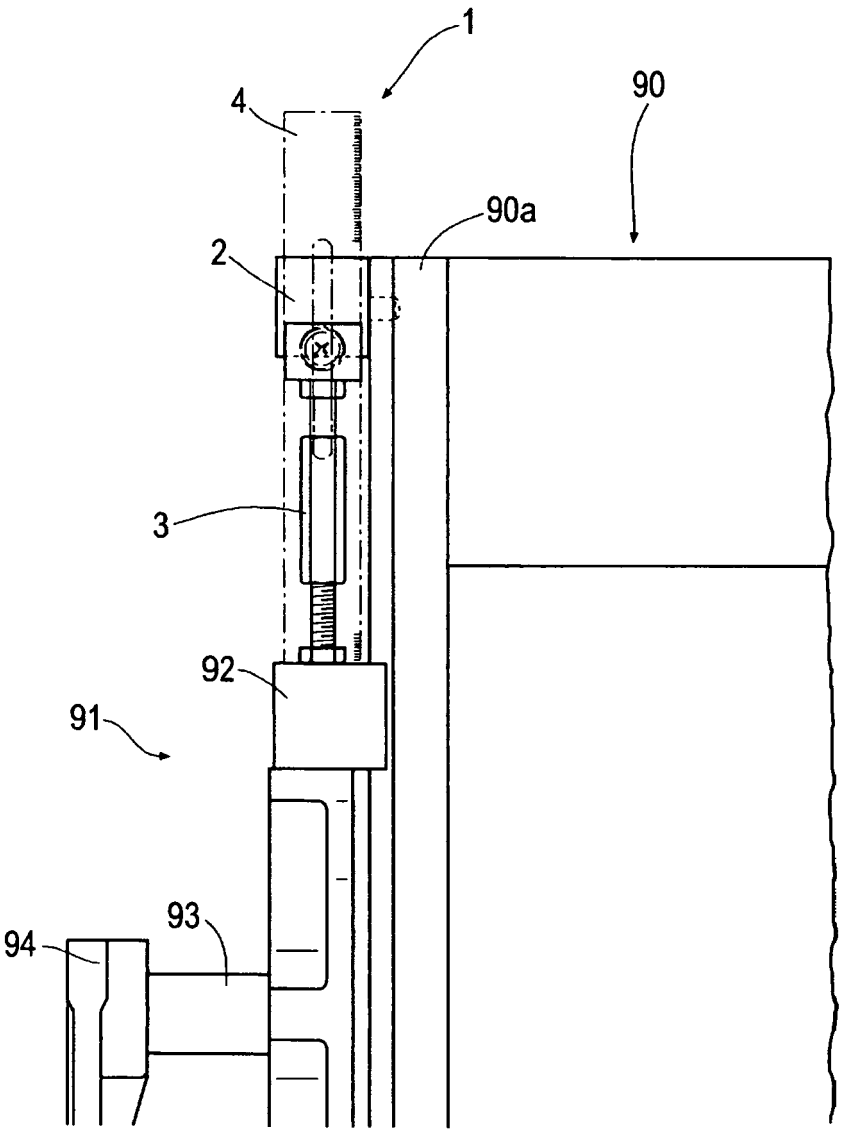
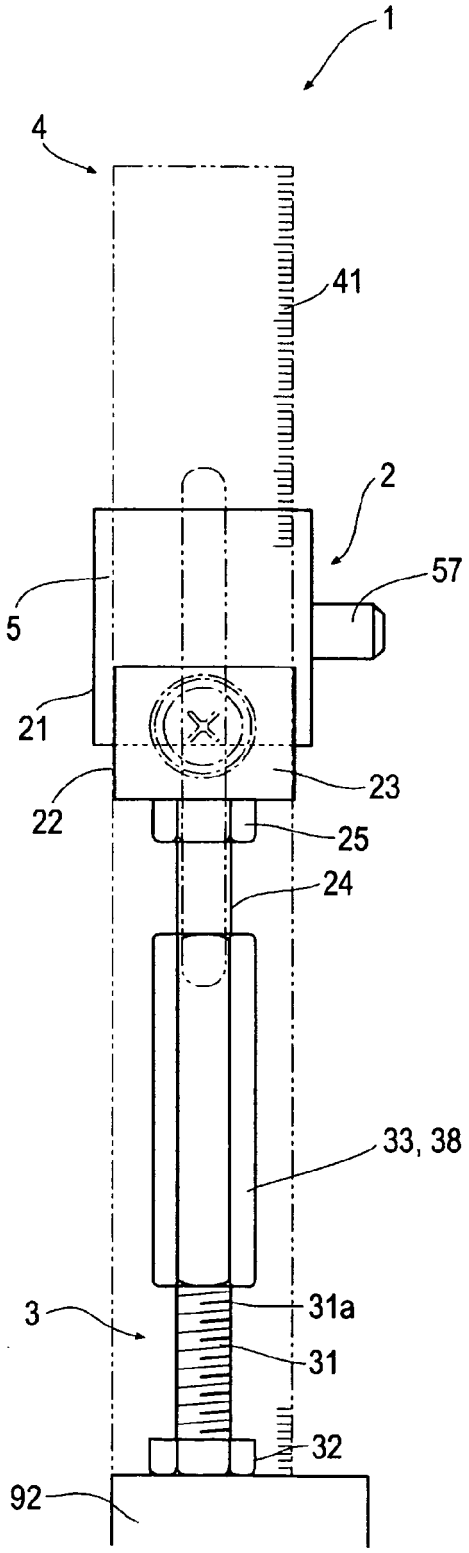


FIG. 8A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31a
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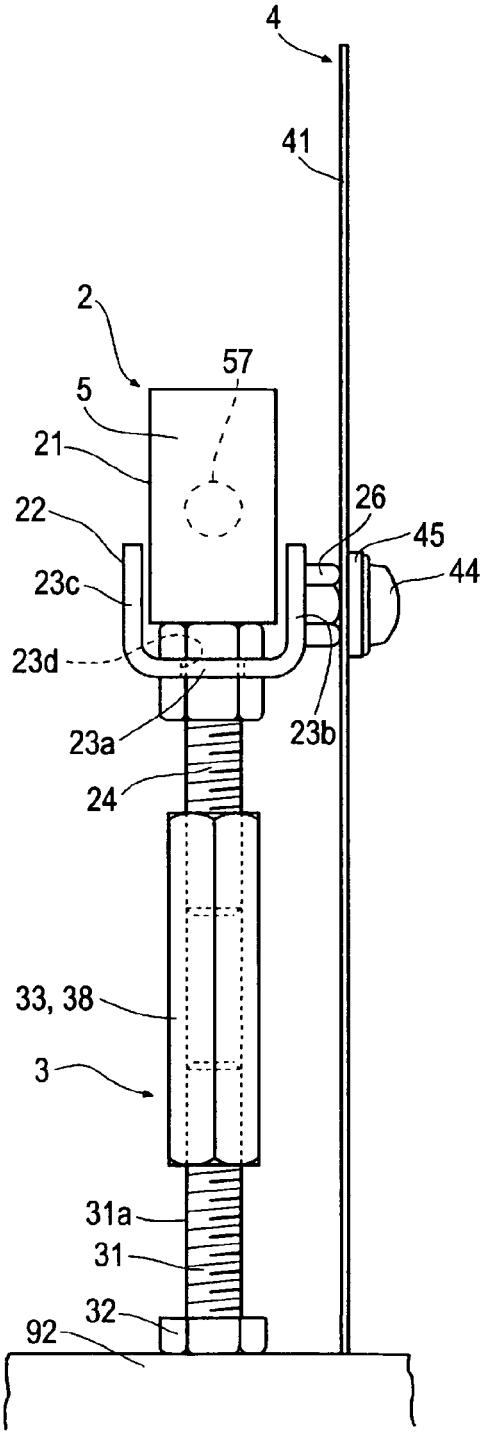
FIG. 8B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31
32
92

FIG. 9

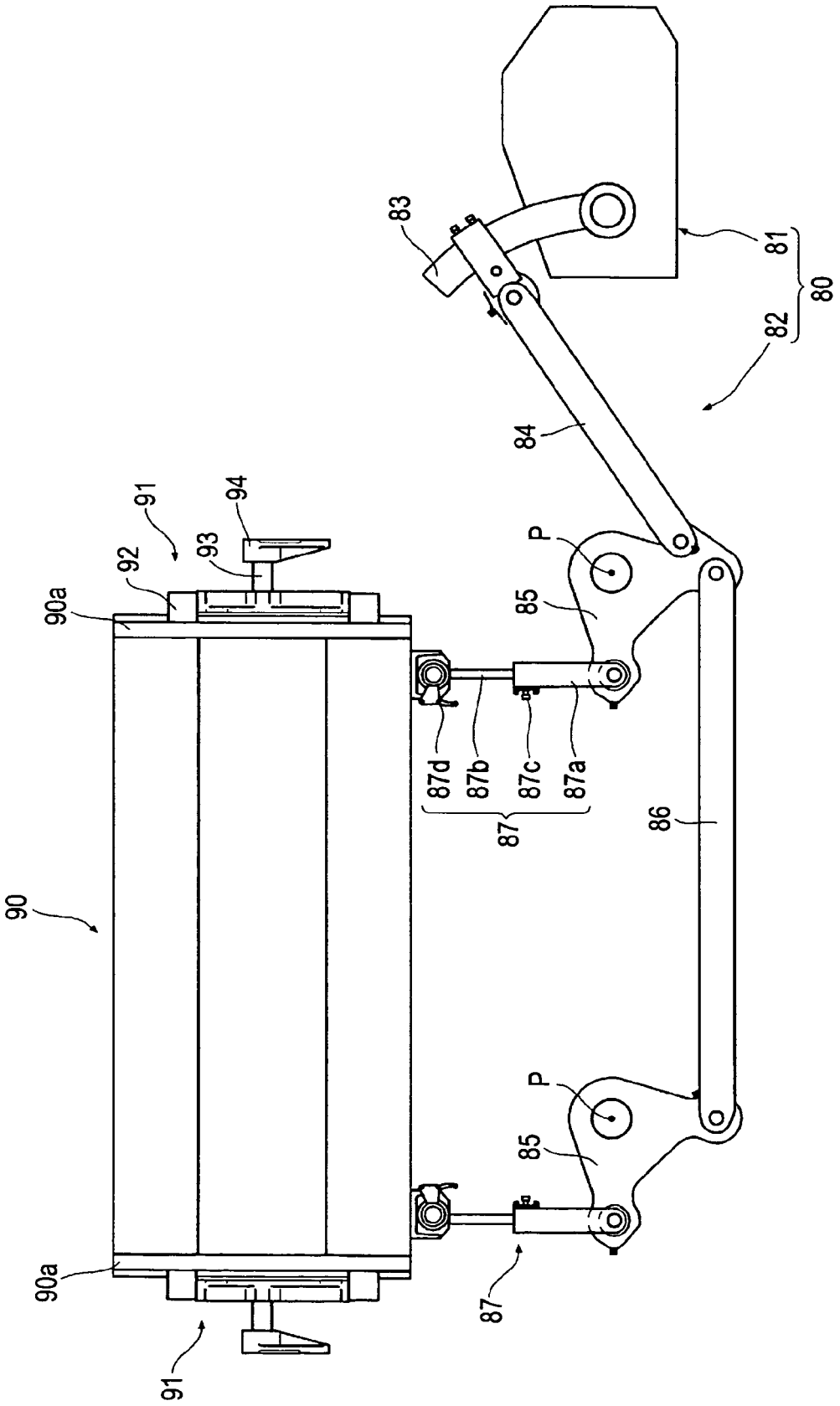
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FIG. 10

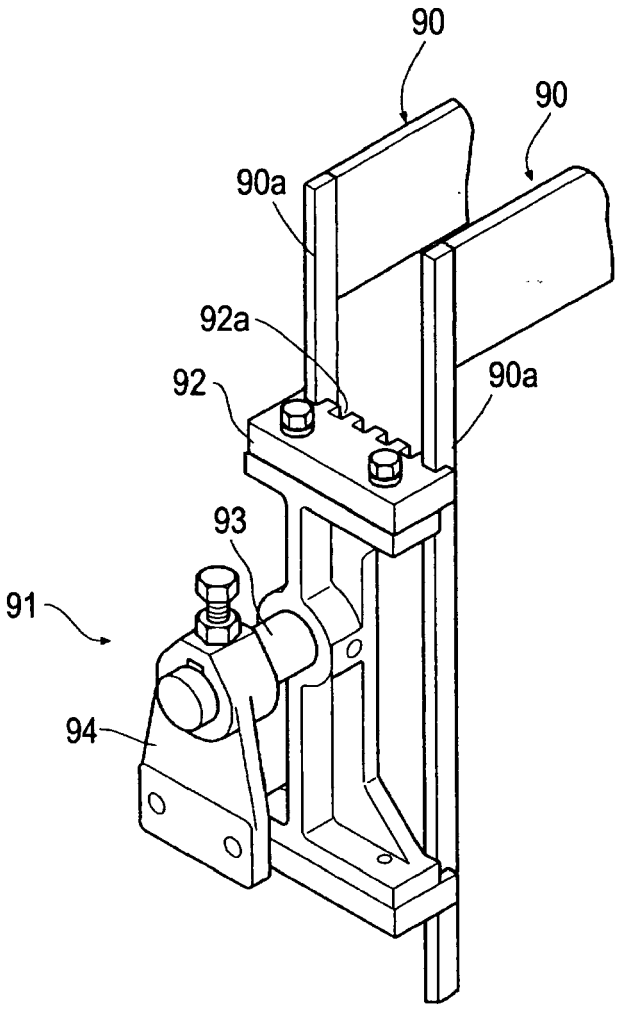


FIG. 11

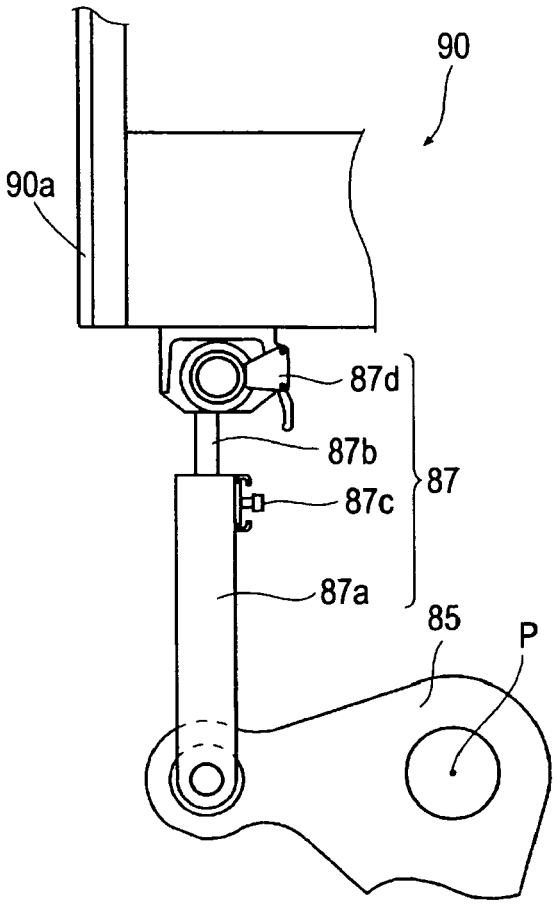
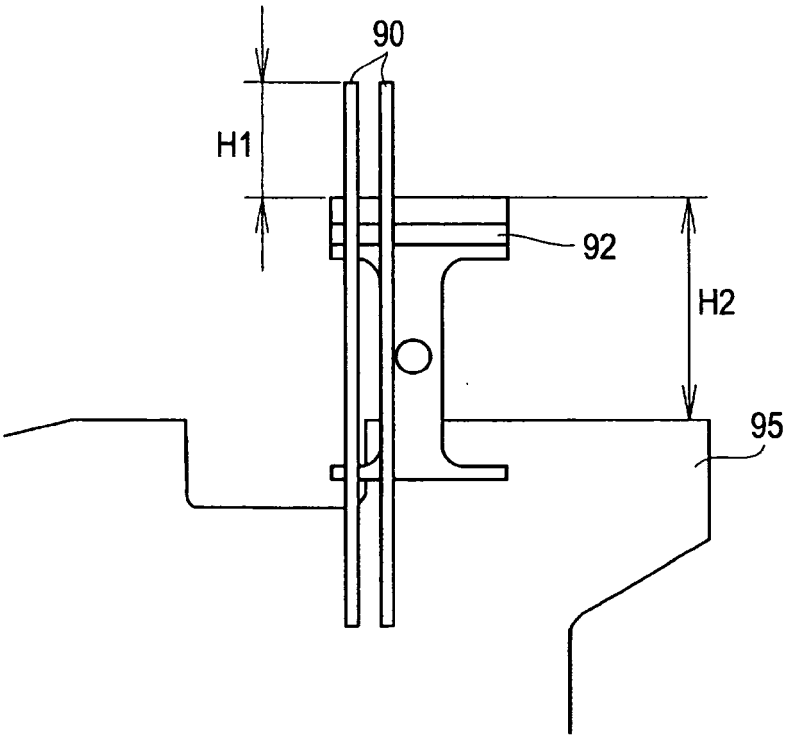


FIG. 12



REFERENCES CITED IN THE DESCRIPTION

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- JP 5230734 A **[0005]**