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(71) Applicant: **KYOWA SEISAKUSHO CO., LTD.**
Saga-shi, Saga-ken (JP)

(72) Inventors:
• **Fujii, Michihiro,**
c/o Kyowa Seisakusho Co., Ltd.
Saga-shi, Saga-ken (JP)

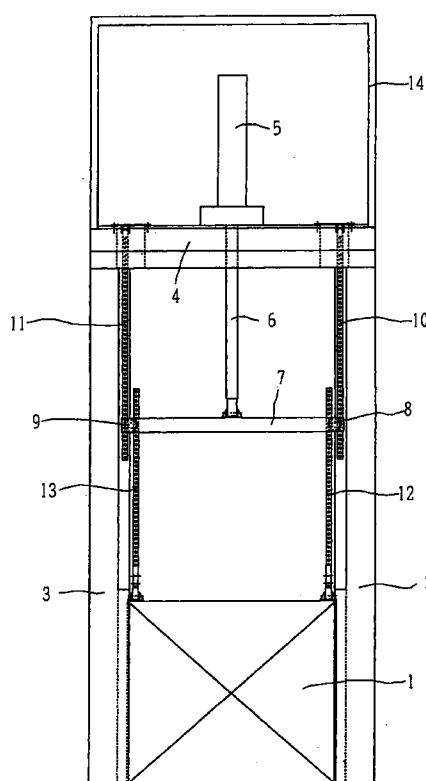
• **Soejima, Kiyofumi,**
c/o Kyowa Seisakusho Co., Ltd.
Saga-shi, Saga-ken (JP)

(74) Representative: **Goddard, Heinz J., Dr. et al**
FORRESTER & BOEHMERT
Franz-Joseph-Strasse 38
80801 München (DE)

(54) Double pinion cylinder type operating apparatus

(57) There is provided an operating apparatus in which even if a lift of ascent and descent of a gate is long, the cylinder stroke can be suppressed to a level lower than the lift, and the buckling strength of the cylinder rod need not be increased. A double pinion cylinder type operating apparatus wherein a cylinder is arranged on a gatepost slab above stanchions on both sides of a gate to be raised and lowered, a pinion mounting intermediate mount is installed below the cylinder rod of the cylinder, pinions are rotatably provided on both sides of the pinion mounting intermediate mount, stationary racks meshed with either the insides or outsides of the pinions are vertically provided, and lower ends of movable rack bars meshed with the other side of the pinions are secured to the gate. The gate is driven by the movable rack bars meshed with the pinions raised and lowered with the same stroke as that of the cylinder rod raised and lowered by the cylinder. A cylinder stroke of less than half that of the lift of the gate will suffice, accordingly.

Fig. 1



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Description

TECHNICAL FIELD

The present invention relates to a hydraulic (liquid pressure) cylinder type operating apparatus for closing a sluice and the like.

BACKGROUND

As lifting and driving mechanisms for an operating apparatus for closing a sluice and the like, a rack type operating apparatus and a hydraulic cylinder type operating apparatus have been heretofore employed.

The rack type operating apparatus provide limited in performance when a winding load is increased. To cope with this, the operating apparatus body must be made larger, and a larger space is therefore necessary.

On the other hand, in the hydraulic cylinder type operating apparatus, the cylinder rod is driven through working oil. Since the performance of the apparatus can be adjusted by changing the diameter of the cylinder and the hydraulic pressure, a large space is not necessary. Even the operating speed can be simply affected by adjusting the amount of oil.

However, the hydraulic cylinder type operating apparatus has a drawback in that as the cylinder stroke becomes longer, the cylinder rod is more likely to buckle. Therefore, this apparatus is not suitable for an operation that requires a long stroke.

DISCLOSURE OF THE INVENTION

An object of the present invention is to provide an operating apparatus in which even if the lift of the gate is long, the cylinder stroke can be kept at a shorter than the lift, and the buckling strength of a cylinder rod need not be increased.

According to a first double pinion cylinder type operating apparatus of the present invention, a cylinder is arranged on a gatepost slab above stanchions on both sides of a gate to be raised and lowered, a pinion mounting intermediate mount is installed below the cylinder rod of the cylinder, pinions are rotatably provided on both sides of the pinion mounting intermediate mount, stationary racks meshed with either the insides or outsides of the pinions are vertically provided, and the lower ends of movable rack bars meshed with the other sides of the pinions are secured to the gate.

Further, according to a second double pinion cylinder type operating apparatus of the present invention, cylinder type operating apparatuses for driving a first and a second pinions within a pinion mounting intermediate mount are installed outside stanchions on both sides of a gate to be raised and lowered, the cylinder operating apparatuses and both ends of the pinion mounting intermediate mount are connected by means of pins, a first and a second shaft are rotatably provided on the left and right sides in the pinion mounting intermediate mount,

the first pinion meshed with a stationary rack and the second pinion meshed with a lifting rack are arranged on the axis, a connecting shaft is provided to synchronize rotations of the first shaft and the second shaft on the left and right sides, the connecting shaft and the first and second shafts are coupled by a coupling, and the lower end of the lifting rack is secured to the gate.

Furthermore, according to a third double pinion cylinder type operating apparatus of the present invention, a cylinder type operating apparatus for driving pinions in a pinion mounting intermediate mount is installed outside stanchions on both sides of a gate to be raised and lowered, the cylinder operating apparatus and both ends of the pinion mounting intermediate mount are connected by pins, pinions are rotatably mounted on both sides in the pinion mounting intermediate mount, a stationary rack meshed with either insides or outsides of the pinions are vertically provided, and lower ends of movable rack bars meshed with the other sides of the pinions are secured to the gate.

In the present invention, the gate is driven by the movable rack bars meshed with the pinions, and is raised and lowered with the same stroke as that of the cylinder rod raised and lowered by the cylinder. A cylinder stroke of half or less that of the gate lift will suffice, accordingly.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view showing a first embodiment of the present invention; FIG. 2 is an enlarged front view showing essential parts; FIG. 3 is an enlarged cross-sectional view showing essential parts; FIG. 4 is a front view showing a second embodiment of the present invention; FIG. 5 is an enlarged front view showing essential parts of a second embodiment; FIG. 6 is a side view of FIG. 5; FIG. 7 is an enlarged cross-sectional view showing essential parts according to the second embodiment; FIG. 8 is a front view showing a third embodiment of the present invention; FIG. 9 is an enlarged front view showing essential parts of a second embodiment; FIG. 10 is a side view of FIG. 9; and FIG. 11 is an enlarged cross-sectional view showing essential parts according to the third embodiment.

BEST MODE FOR CARRYING OUT THE INVENTION

The present invention will be described hereinafter by way of embodiments.

In the drawings, a hydraulic cylinder type operating apparatus 5 is installed above a gatepost slab 4 at upper parts of stanchions 2 and 3 on both sides of a gate 1 to be raised and lowered. A pinion mounting intermediate mount 7 raised and lowered by a cylinder rod 6 of the hydraulic cylinder type operating apparatus 5 is installed below the gatepost slab 4, and pinions 8 and 9 are rotatably provided on both sides of the pinion mounting intermediate mount 7. Stationary racks 10 and 11 meshed with the outside of the pinions 8 and 9 are vertically mounted insides the stanchions 2 and 3, and lower ends

of movable racks 12 and 13 meshed with the insides of the pinions 8 and 9 are secured to the gate 1. The operating apparatus 5 is housed in an upper house 14.

When the stationary racks 10 and 11 are disengaged from the pinions 8 and 9, it is dangerous. Therefore, guide rollers 15 and 16 are provided outside the stationary racks 10 and 11.

Further, as shown in FIG. 3, longitudinal grooves are formed on the stanchions 2 and 3 (only one of which is shown), the inside of which is provided with a door stop 17. Rollers 18 and 19 are provided to front, back, and sides of the pinion mounting intermediate mount 7 to prevent it from deflecting.

The operation of the first embodiment constructed as said above will now be described.

When the hydraulic cylinder type operating apparatus 5 is driven to raise the cylinder rod 6 at a speed of u (m/min), the pinion mounting intermediate mount 7 and the center shafts of the pinions 8 and 9 are also moved upward at a speed of u (m/min). The external teeth of the pinions 8 and 9 are not moved by means of the stationary racks 10 and 11, and the center shafts of the pinions 8 and 9 are raised at a speed of u (m/min). Therefore, the internal teeth of the pinions 8 and 9 rotate at a linear speed of $2u$ (m/min). With this, the movable rack bars 12 and 13 meshed with the internal teeth of the pinions 8 and 9 are raised at a speed of $2u$ (m/min). Since the speed of the cylinder rod 6 is the same as that of the movable rack bars 10 and 11, when the gate 1 moves upward by lift Hm , the cylinder rod 6 moves upward by $Hm/2$.

Next, the second embodiment of the present invention will be described.

FIG. 4 is a front view showing the second embodiment of the present invention; FIG. 5 is an enlarged front view of essential parts; FIG. 6 is a side view of FIG. 5; and FIG. 7 is an enlarged cross-sectional view of essential parts.

In the first embodiment, the hydraulic cylinder 5 is mounted above the gatepost slab 4 with the cylinder rod 6 directed downward, whereas in the present embodiment, hydraulic cylinders 21 and 22 are mounted at upper parts of stanchions 2 and 3 with cylinder rods 23 and 24 directed upward. A pinion mounting intermediate mount 25 is mounted at upper parts of the cylinder rods 23 and 24.

The pinion mounting intermediate mount 25 is moved up and down by the hydraulic cylinders 21 and 22 while being guided in all directions by guide rollers 26 and 27. A shaft 28 is supported on the pinion mounting intermediate mount 25, and is provided with a first pinion 29 and a second pinion 30. A stationary rack 31 meshed with the first pinion 29 is secured to the stanchions 2 and 3, and the gate 1 is secured to the lower end of a movable rack 32 meshed with the second pinion 30. Rollers 33 and 34 are provided outside the stationary rack 31 and the movable rack 32 to prevent the first and second pinions 29 and 30 from becoming disengaged.

In the second embodiment, when both ends of the pinion mounting intermediate mount 25 are moved up and down by the hydraulic cylinders 21 and 22, the first pinion 29 meshed with the stationary rack 31 is rotated whereby the shaft 28 rotates, and the second pinion 30 also rotates at the same speed as the first pinion 29. Since the movable rack 32 is meshed with the second pinion 30, the second pinion 30 rotates whereby the movable rack 32 is also moved up and down. Here, if the ratio of the number of teeth of the first pinion 29 to that of the second pinion 30 is 1 : 1, the tangential speed of the stationary rack 31 is equal to that of the movable rack 32. Thus, the movable rack 32 also moves up and down at the same speed as the lifting speed of the pinion mounting intermediate mount 25. That is, the movable rack 32 is to be moved up and down by twofold the distance of a stroke of the hydraulic cylinders 21 and 22.

By changing the ratio of the number of teeth of the first pinion 29 to that of the second pinion 30, the lifting stroke of the movable rack 32 can be set to threefold and fourfold the stroke of the hydraulic cylinders 21 and 22.

Further, since the left and right pinions are both connected by the shaft 28, the lifting strokes of the hydraulic cylinders 21 and 22 are assuredly harmonized.

Other constructions and operations are similar to those of the first embodiment, and their descriptions will therefore be omitted.

Hereinafter, the third embodiment of the present invention will be described.

FIG. 8 is a front view showing the third embodiment of the present invention; FIG. 9 is an enlarged front view of essential parts; FIG. 10 is a side view of FIG. 9; and FIG. 11 is an enlarged cross-sectional view of essential parts.

In the present embodiment, in the same manner as the second embodiment, hydraulic cylinders 23 and 24 are mounted above the stanchions 2 and 3 of the gate 1 with cylinder rods 23 and 24 directed upward. A pinion mounting intermediate mount 25 is mounted at the upper parts of the cylinder rods 23 and 24.

The pinion mounting intermediate mount 25 is moved up and down by the hydraulic cylinders 21 and 22 while being guided in all directions by a guide roller 41 and a guide shoe 42. Pinions 43 are rotatably provided on both sides of the pinion mounting intermediate mount 25. A stationary rack 44 meshed with the outside of the first pinion 43 is secured to a mount 51 above the stanchions 2 and 3, and the gate 1 is secured to the lower end of a movable rack bar 45 meshed with the insides of the pinion 43. Rollers 46 and 47 are provided outside the stationary rack 44 and the movable rack 45 to prevent them from becoming disengaged from the pinion 43.

In the third embodiment, when both ends of the pinion mounting intermediate mount 25 are moved up and down by the hydraulic cylinders 21 and 22, the pinion 43 meshed with the stationary rack 44 is rotated, thereby rotating the shaft 28. Since the movable rack 45 is meshed with the pinion 43, the pinion 43 rotates, causing the movable rack 45 to move up and down.

The external teeth of the pinion 43 are made immovable by means of the stationary rack 44, and the tangential speed of the stationary rack 44 is equal to that of the movable rack 45. Thus, the movable rack 45 is also moved up and down at the same speed as the lifting speed of the pinion mounting intermediate mount 25. That is, the movable rack 45 is to be moved up and down by twofold the distance of the stroke of the hydraulic cylinders 21 and 22.

Other constructions and operations are similar to those of the first embodiment, and their descriptions will therefore be omitted.

The apparatus of the first embodiment is for a gutter gate and a gutter pipe, and is used where water is so deep that the cylinder type operating apparatus will probably be immersed.

The apparatus of the second and third embodiments is for a dam, and is used where water is so shallow that the cylinder type operating apparatus does not reach water level.

As described above, according to the present invention, when the gate is moved up by the lift as required, the cylinder rod of the cylinder will suffice if moved up by half a stroke or less of the lift. Therefore, it is not necessary to have a cylinder which is high in buckling resistance and has the same length as that of the lift of the gate. Further, the ceiling of the upper house housing therein will only need be about half the height of the lift. It is not necessary to make the ceiling higher according to the lift of the gate. Thus, the ceiling of the upper house can be lower, and will not obstruct the view.

The features disclosed in the foregoing description, in the claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

Claims

1. A double pinion cylinder type operating apparatus characterized in that a cylinder is arranged on a gatepost slab above stanchions on both sides of a gate to be raised and lowered, a pinion mounting intermediate mount is installed below a cylinder rod of the cylinder, pinions are rotatably provided on both sides of the pinion mounting intermediate mount, stationary racks meshed with either the insides or outsides of the pinions are vertically provided, and lower ends of movable rack bars meshed with the other sides of the pinions are secured to the gate.
2. A double pinion cylinder type operating apparatus characterized in that cylinder type operating apparatuses for driving a first and a second pinions within a pinion mounting intermediate mount are installed outside stanchions on both sides of a gate to be raised and lowered, the cylinder operating apparatuses and both ends of the pinion mounting intermediate mount are connected by means of pins, a first and a second shaft are rotatably provided on the left and right sides in the pinion mounting intermediate mount, the first pinion meshed with a stationary rack and the second pinion meshed with a lifting rack are arranged on-the-axis, a connecting shaft is provided to synchronize rotations of the first shaft and the second shaft on the left and right sides, the connecting shaft and the first and second shafts are coupled by a coupling, and the lower end of the lifting rack is secured to the gate.
3. A double pinion cylinder type operating apparatus characterized in that a cylinder type operating apparatus for driving pinions in a pinion mounting intermediate mount is installed outside stanchions on both sides of a gate to be raised and lowered, the cylinder operating apparatus and both ends of the pinion mounting intermediate mount are connected by pins, pinions are rotatably mounted on both sides in the pinion mounting intermediate mount, a stationary rack meshed with either the insides or outsides of the pinions, and lower ends of movable rack bars meshed with the other sides of the pinions are secured to the gate.

Fig. 1

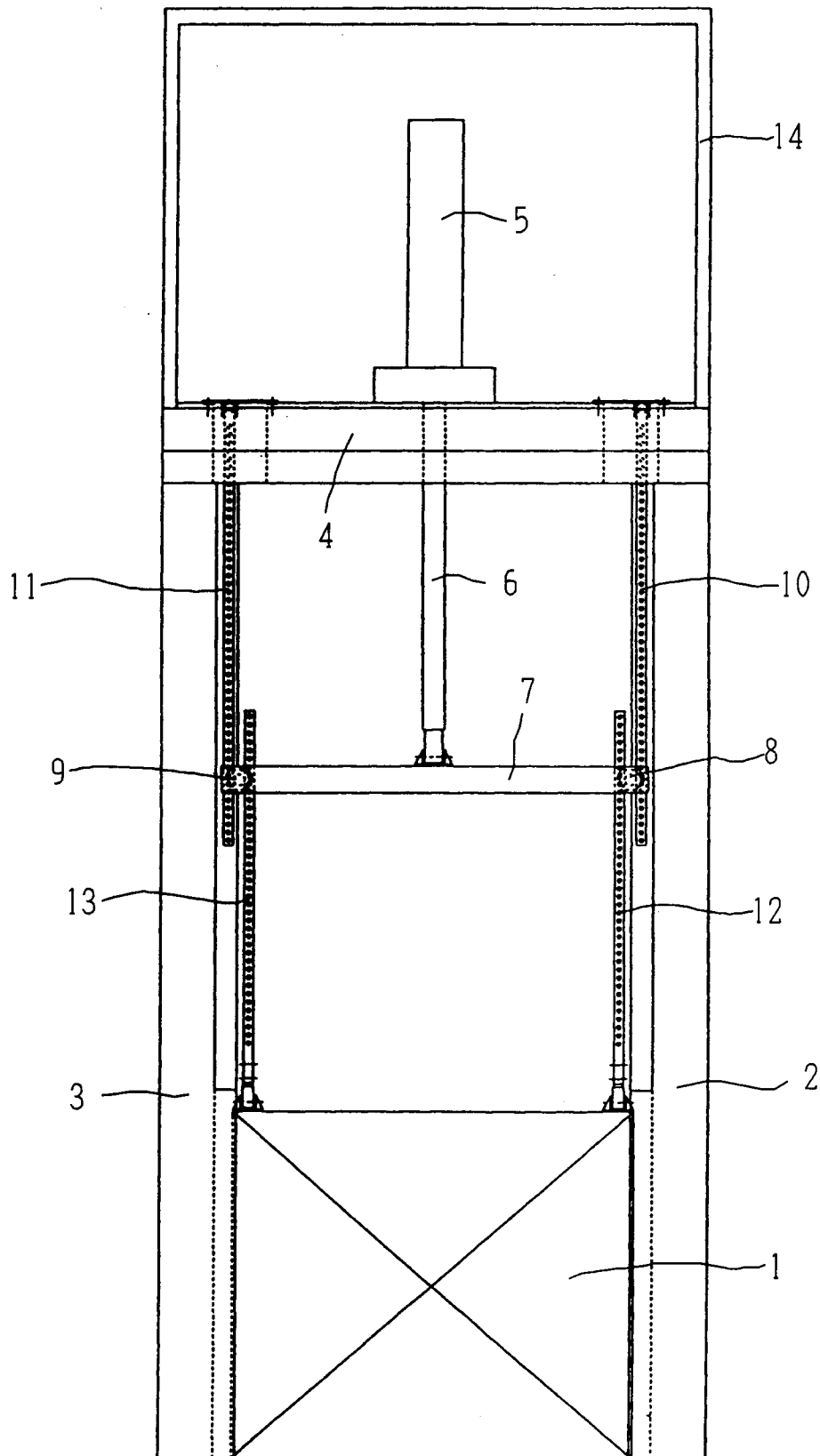


Fig. 2

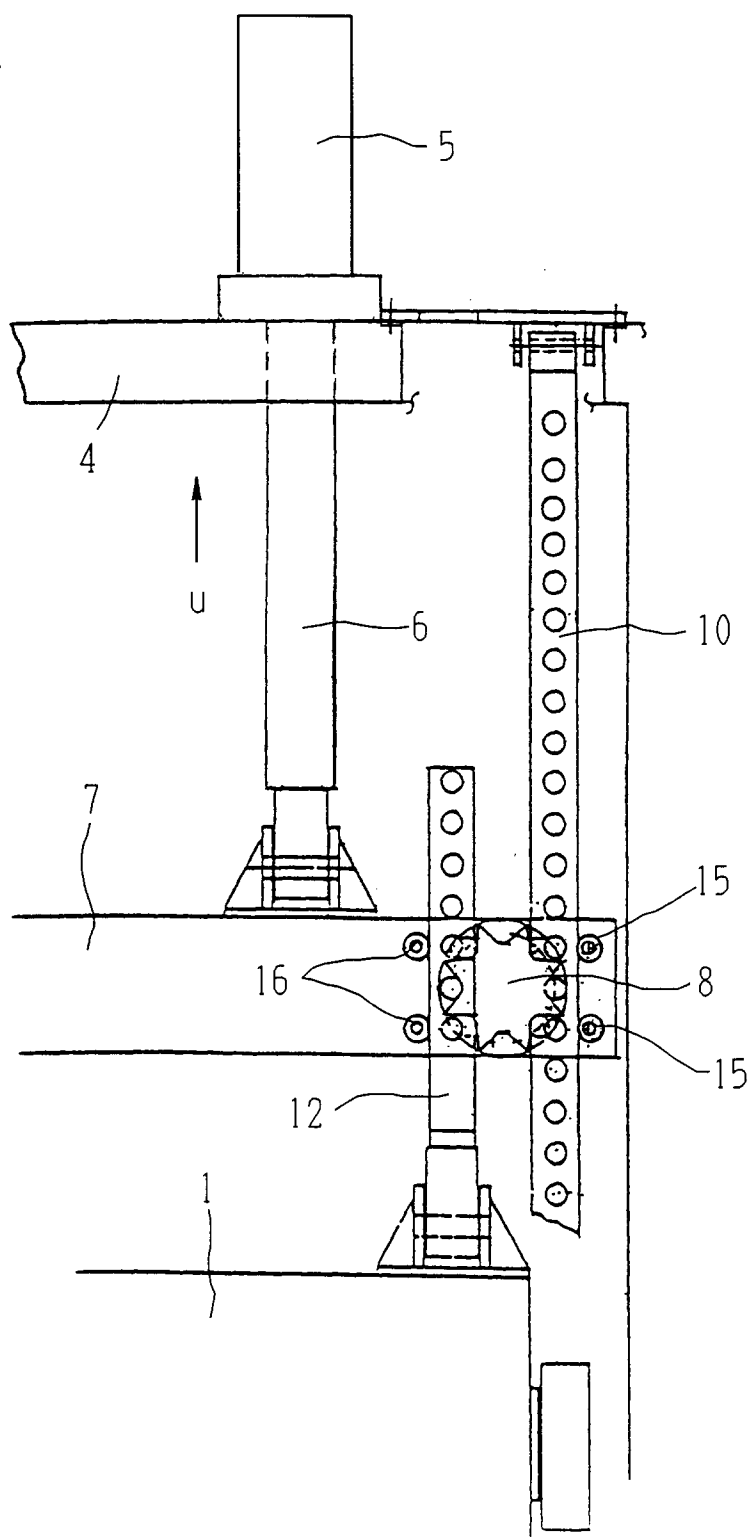


Fig. 3

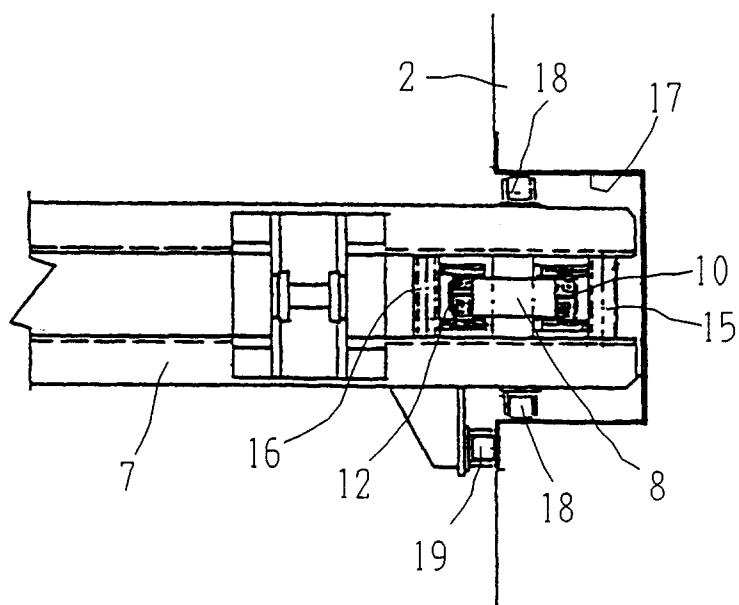


Fig. 4

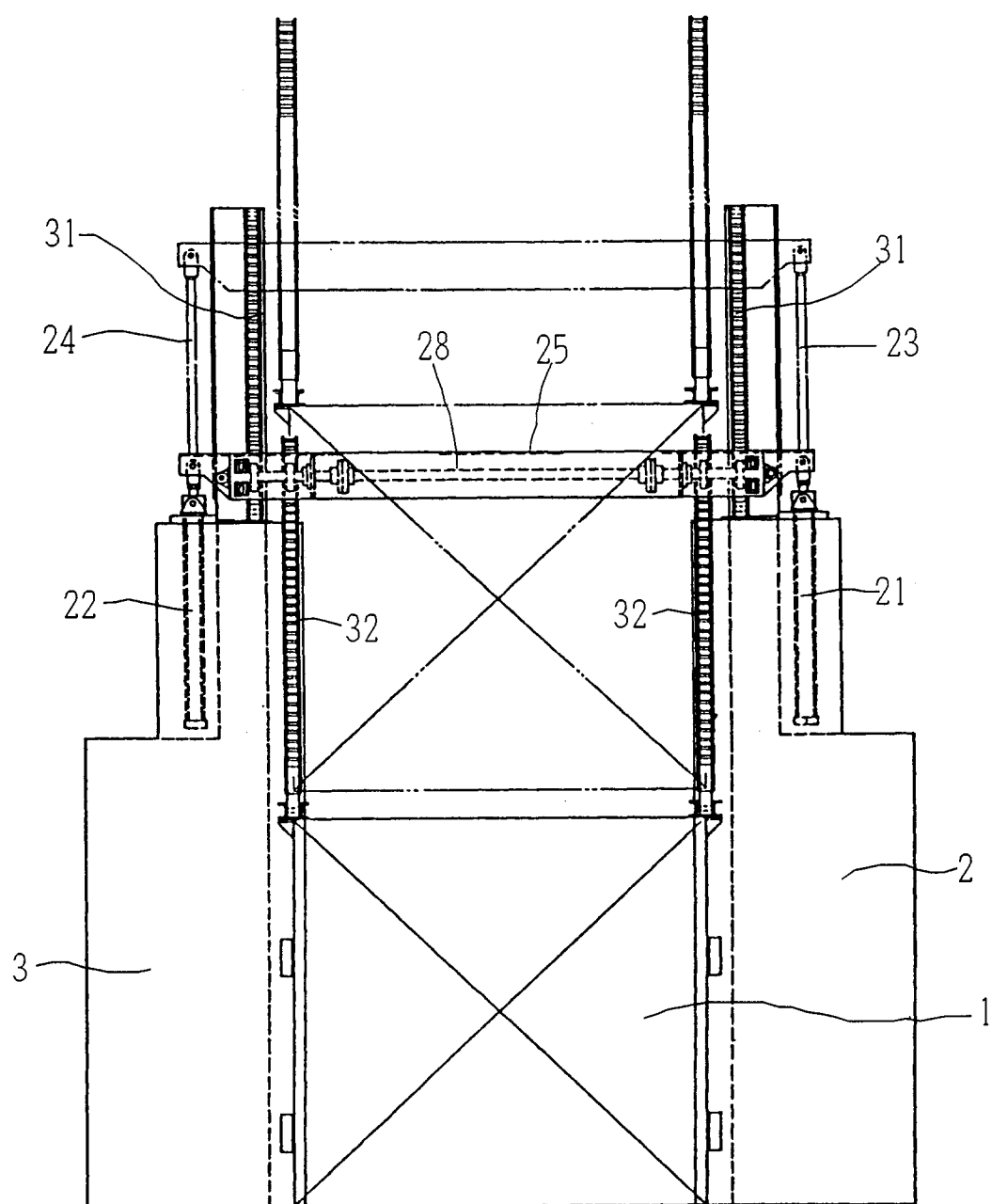


Fig. 5

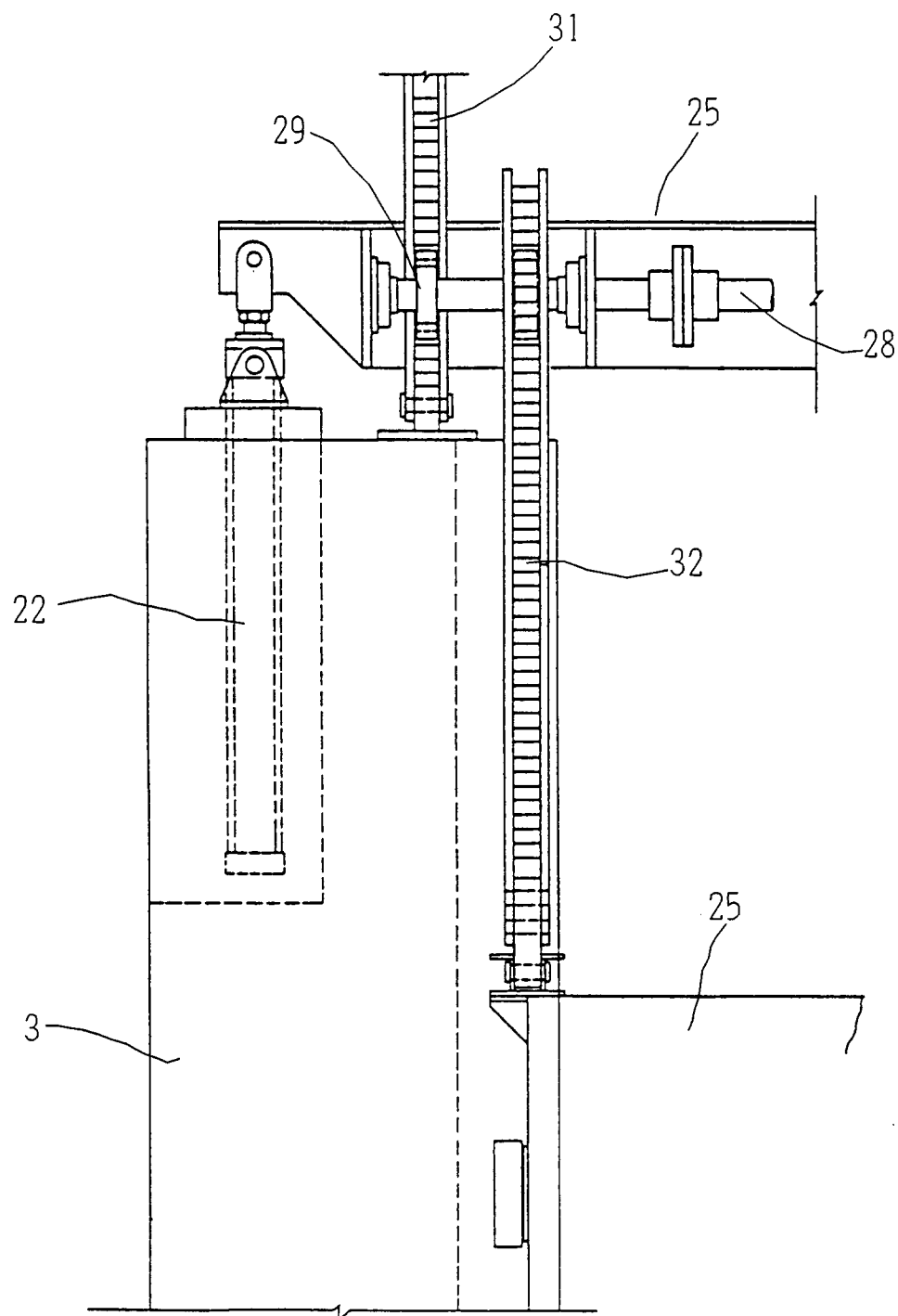


Fig. 6

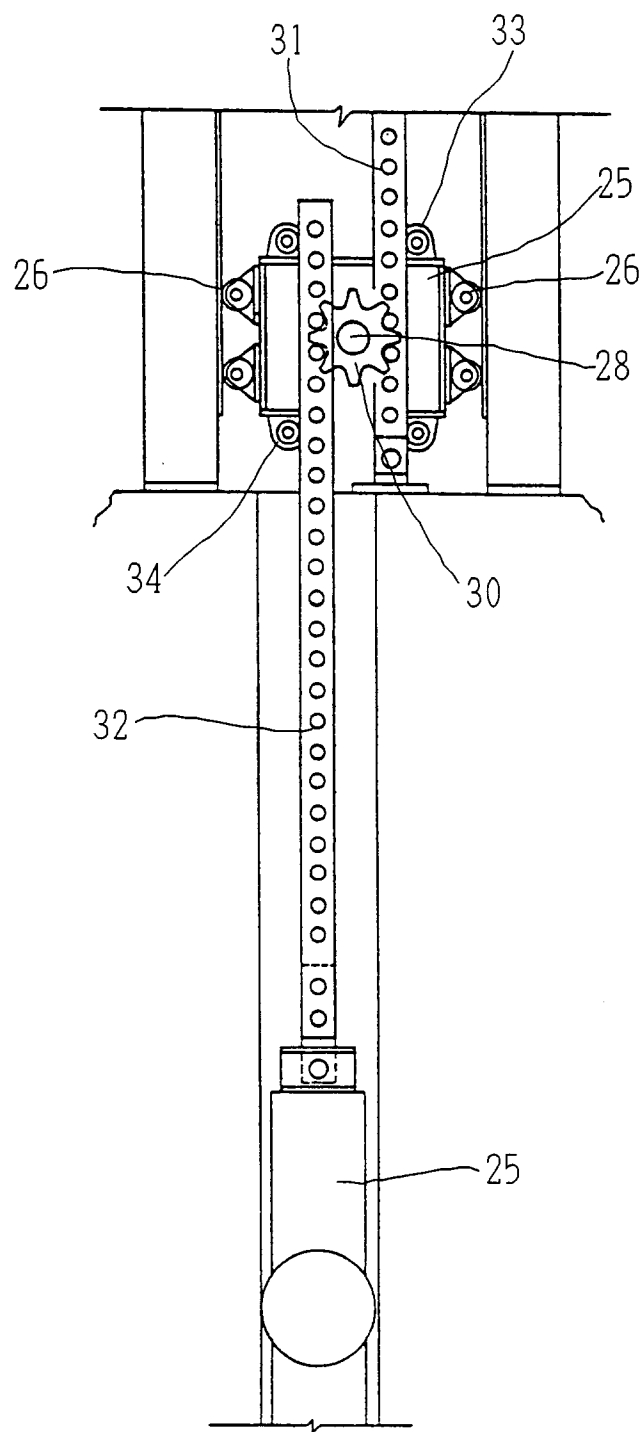


Fig. 7

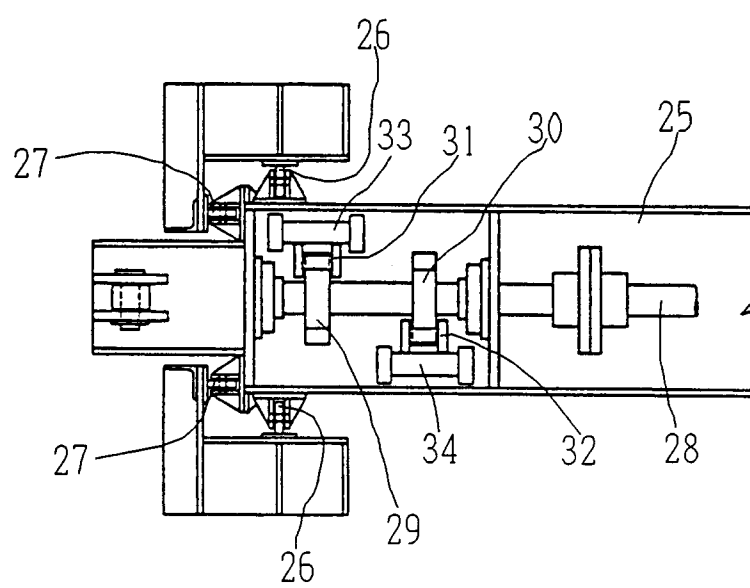


Fig. 8

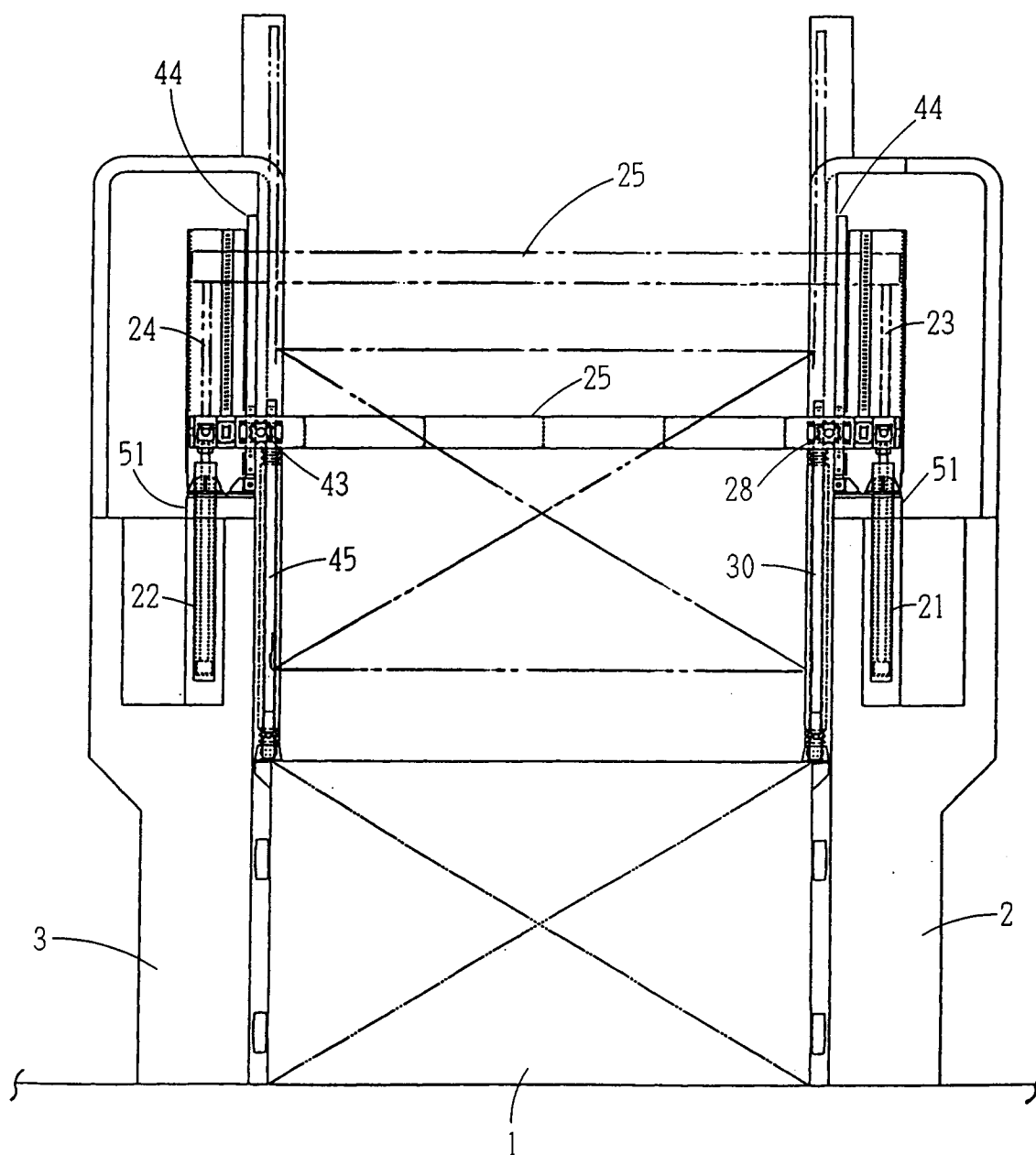


Fig. 9

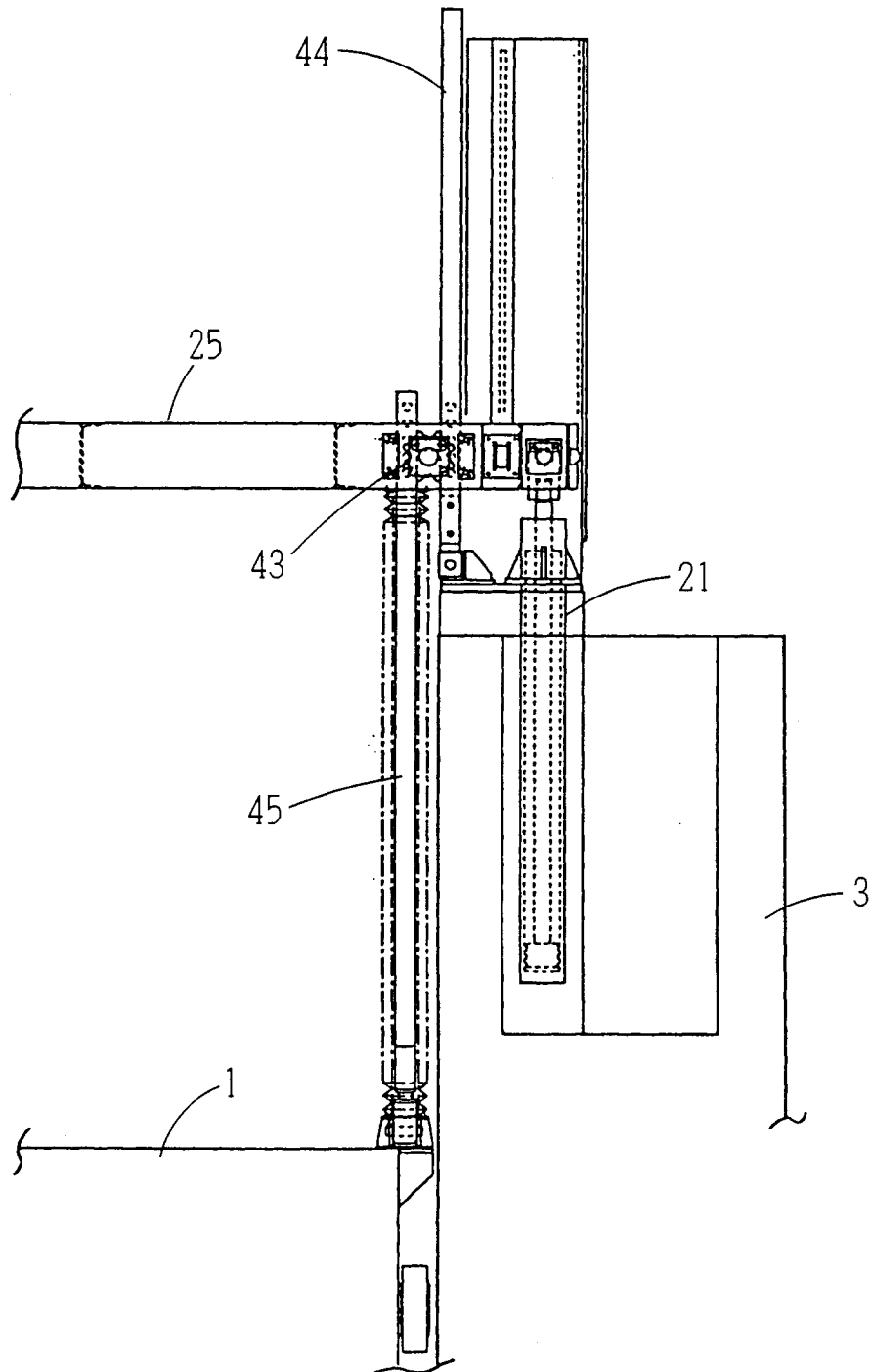


Fig. 10

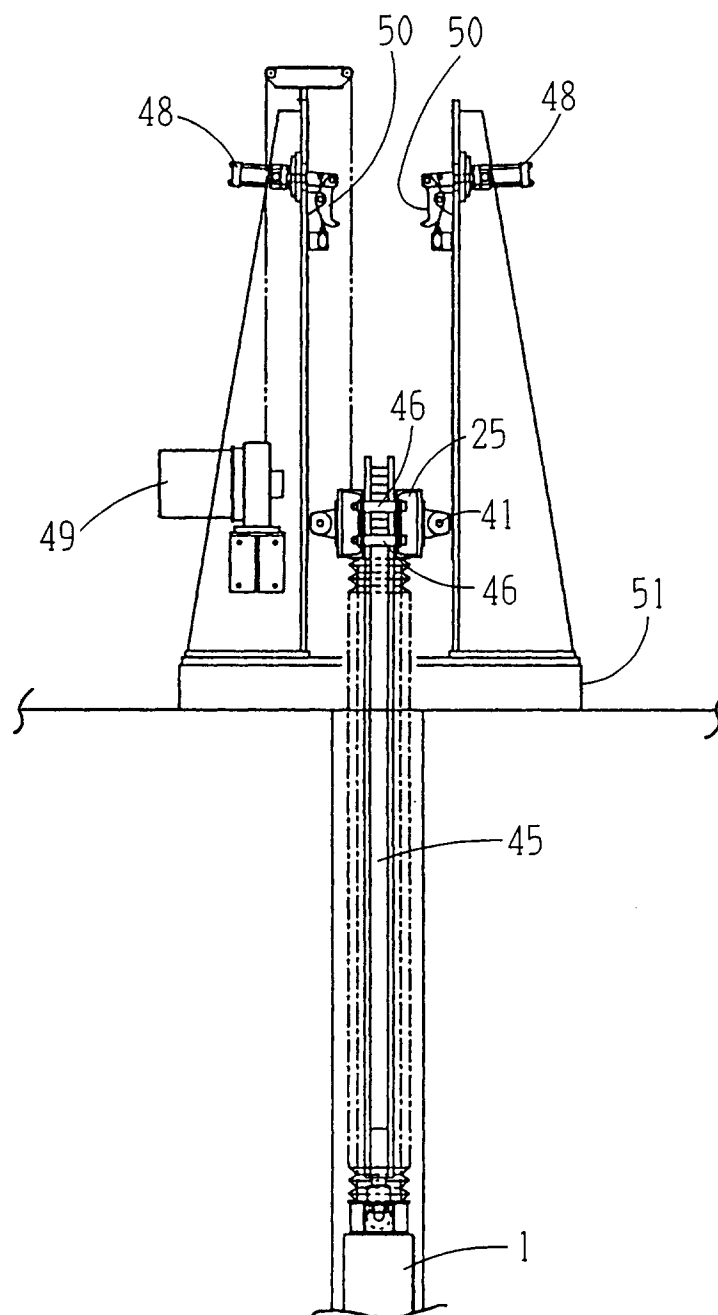


Fig. 11

