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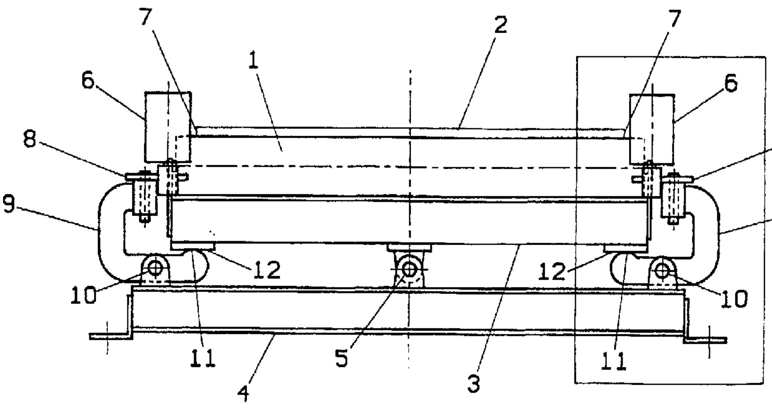
(54) Title: A TRAINING IDLER



(57) Abstract

A training idler has a roller (1) on which a belt (2) is adapted to run. The roller (1) is rotatably mounted on a tilt frame (3) which is pivotally mounted on a base frame (4). One or more servo rolls (6) are mounted adjacent each longitudinal edge (7) of the belt (2). The servo rolls (6) are mounted on a pivotable arm (9) having an end (11) located under the proximal end of the tilt frame (3). If the belt (2) deviates from its intended position, the physical urging of an edge (7) of the belt (2) against a servo roll (6) causes the arm (9) to pivot and raise the proximal end of the tilt frame (3). The tilting of the tilt frame (3) about its pivot connection (5) creates a realigning influence on the belt (2). The arm (9) of the tilting mechanism may be replaced by a wedge mechanism or hydraulic mechanism. Alternatively, the tilting mechanism may include a rack and pinion.

"A TRAINING IDLER"

THIS INVENTION relates to an improved training idler for a belt conveyor. In particular, the invention is directed to a self-actuated training idler which tilts to correct deviation of a belt from its intended position.

BACKGROUND ART

There are known devices which apply the principle of corrective tilting of a thin travelling strip of material sideways in order to maintain the alignment of the strip. The tilting creates differential edge tension in the strip which causes it to re-centre itself in an attempt to equalise these edge tensions.

These devices have generally been used for lightweight or very thin strips, such as a roll of paper in a photocopying process. When misalignment is detected, a training idler on which the strip runs is tilted. These thin strips are not capable of supporting a point load on their edge (such as would occur as part of the process of physically sensing misalignment of the strip and/or tilting the roller). Consequently, the misalignment of the strip may be detected in a non-contact manner and/or the tilting may be power-assisted.

In the case of industrial belt conveyors the edge of the belt is much stronger, but it has still not been recognised that a useful servo input can be obtained from a roller, or rollers, to directly tilt the belt sideways.

Australian patent 658110 describes a training idler in which the physical urging of the belt edge against a servo roller imparts a slewing action to the idler roller. This slewing action is then partially converted into a tilting action, but there is no direct tilting by the servo rollers.

The servo rollers are mounted on long arms which are space consuming. Further, due to the additional realigning effect of the slewing motion, the training idler has a preferred direction of belt travel.

In some known training idlers in which the corrective force is obtained by the urging of the conveyor belt against another member, it is common for the edge of the belt to be damaged as a result of incorrect tracking of the belt.

It is an object of the invention to provide an improved training idler for a conveyor belt.

SUMMARY OF THE INVENTION

This invention provides a training idler for a conveyor belt, comprising

a tilt frame having at least one roller on which the belt is adapted to run, the roller being rotatably mounted to the tilt frame,

at least one servo member adjacent each longitudinal edge of the belt,

tilting means for changing the orientation of the tilt frame and roller if the belt deviates laterally from a predetermined path, to thereby urge the belt in a direction opposite to the deviation,

characterised in that the tilting means is actuated by the physical urging of an edge of the belt against its adjacent servo member and in that the orientation is changed only by tilting the tilt frame and roller about an axis generally parallel to the direction of travel of the belt.

Typically, the tilt frame is pivotally mounted on a base frame, the pivotal mounting between the two allowing only relative tilting between the tilt frame and base frame.

In one embodiment, the tilting means comprises a generally C-shaped arm pivotally mounted between its ends to the base frame, the pivotal mounting of the tilting arm allowing only tilting thereof about an axis generally parallel to the direction of travel of the belt. The servo member is suitably mounted at one end of the C-shaped arm, and its other end abuts the underside of the proximal end of the tilt frame. Thus, when the belt tracks out of alignment, its edge abuts the servo member mounted at one end of the tilting arm, imparting a moment about the pivot axis of the tilting arm, and causing the other end of the tilting arm to tilt the tilt frame in a direction to correct the misalignment of the conveyor belt.

Other tilting mechanisms are described below.

This invention recognises that a useful servo input can be obtained from a roller pressed by the edge of the belt, to directly tilt, and only tilt, the belt sideways, and this offers the following advantages:

(a) The tilting system is more compact.

(b) The system is not sensitive to the direction of belt travel, and is therefore particularly suitable for reversing belts.

(c) The system is suitable for retrofitting to existing idler sets on a conveyor.

Typically, the servo member is a rolling element or "roll". In a preferred embodiment, the servo member comprises a pair of rolls each rotatably mounted to a support arm which, in turn, is pivotally mounted so as to pivot about an axis between the pair of rolls.

With conveyor belts, it is common for the edge of the belt to be damaged due to problems controlling the tracking of the belt, and the rolls are much more tolerant of this edge damage as they provide a lead in for the damaged section. A dual pivoting servo roll system is more effective again as the lead roll will pivot out of the way to allow the damaged section to enter.

In order that the invention may be more fully understood and put into effect, various embodiments thereof will now be described with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a transverse sectional view of a conveyor having a training idler according to one embodiment of the invention;

Fig. 2 is an end view on the training idler in

Fig. 1, looking on the side of the belt conveyor;

Fig. 3 is a modified portion of Fig. 1, depicting another embodiment of the invention;

Fig. 4 is a modified portion of Fig. 1, depicting another embodiment of the invention;

Fig. 5 is a modified portion of Fig. 1, depicting another embodiment of the invention;

Fig. 6 is an end view of the training idler of Fig. 5;

Fig. 7 is a modified portion of Fig. 1, depicting another embodiment of the invention; and

Fig. 8 is a sectional view across the conveyor, depicting another embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

As shown in Fig. 1 and Fig. 2, an idler roller 1 supports a conveyor belt 2, and is rotatably mounted on a tilt frame 3. The tilt frame 3 is pivotably mounted on a base frame 4 by a pivot mounting 5, which enables the tilt frame to tilt sideways relative to the base frame (i.e. about an axis generally parallel to the direction of belt travel).

Two servo rollers or "rolls" 6 are mounted adjacent to each edge 7 of the belt 2. The two servo rolls 6 near each edge 7 are rotatably mounted at opposite ends of a support arm 8. Each servo roll 6 is freely rotatable about an axis generally perpendicular to the portion of the belt near the servo roll. The support arm 8, in turn, is pivotably mounted at the top of arm 9 such that the support arm 8 is pivotable about an axis located between the two rolls 6 and parallel to the rotational axes of the rolls 6.

The arm 9 is pivotally mounted on the base frame 4 by a pivot connection 10. The pivoting arm 9 is able to tilt on its pivot 10 about an axis generally parallel to the direction of belt travel, i.e. it is able to tilt sideways.

When the belt 2 in Fig. 1 moves off centre, say to the right, the right edge 7 of the belt 2 comes into contact with servo rolls 6 on the right side of the belt, urging the arm 9 on that side to rotate in a clockwise direction about the pivot 10. The lower end of the arm 9 moves upwards as a consequence and engages a plate 12 on the underside of the tilt frame 3. As the arm 9 pivots clockwise, it raises the right end of the tilt frame 3 about the pivot axis of pivot 5. The resultant increase in tension on the right hand side of the belt, and the associated lowering of tension in the left hand side causes the belt to move to the left, or back towards its central position. Thus, the arm 9 imparts a corrective re-aligning influence on belt 2 by tilting the tilt frame 3.

A similar corrective action is performed by the arm 9 at the left side of the conveyor if the belt moves off centre to the left.

Other embodiments of the invention will now be described. In these embodiments, like parts have been identified by the same numeral.

In the modified embodiment of Fig. 3, each arm 9 is replaced by a pivotably mounted arm 13 which is pivotally connected to a wedge 14 at its lower end. The wedge 14 slides on a plate 15 attached to the base frame 4 and is set a nominal distance from a mating plate 16 on the tilt frame 3. As the arm 13 pivots in response to a misaligned belt 2, the wedge 14 slides inwardly along the plate 15 and engages the plate 16, which in turn raises the corresponding end of the tilt frame 3 as in Fig. 1.

In the alternative embodiment of Fig. 4, an angled arm 17 is pivotably mounted to the tilt frame 3 instead of the base frame 4 as in Fig. 1. The arm 17 is shaped such that its lower end 18 moves in a partially downward direction as its upper end pivots outwardly in response to a misaligned belt impinging against the servo roll 6 on its upper end. The lower end of arm 18 pushes on plate 19 attached to the base frame 4, and in turn raises the proximal end of the tilt frame 3.

In the embodiment of Fig. 5 and Fig. 6, the pivoting arm in Fig. 4 is replaced with a pair of cylindrical tubes, with an oblique interface. The lower tube 20 is fixed to the base frame 4 and the upper tube 21 is free to pivot about an axis coaxial with the lower tube.

A servo roll 22 is mounted on a radius arm 23 which is rigidly attached to the upper part of the upper tube 21 and extends radially therefrom. An arm 24 is mounted on the lower part of upper tube 21 with nominal clearance on the tilt frame plate 12.

When the misaligned belt 2 pushes on the servo roll 22, it causes the radius arm 23 and the upper tube 21 to rotate about their common axis, which in turn, causes the upper tube 21 to lift due to its oblique interface with the fixed lower tube 20. This in turn raises the arm 24 which comes into contact with upper frame plate 12, thereby raising the proximal end of the tilt frame 3.

The oblique interface can also take the form of a single or multistart screw thread. That is, the upper and lower parts 21, 20 may be threaded together. A dual servo roll arrangement as depicted in Fig. 1 and Fig. 2 can be used in place of the single servo roll 22.

In the further embodiment of Fig. 7, hydraulic principles are used. A set of servo rolls 6 is mounted to the piston rod 25 of a master hydraulic cylinder 26. This cylinder 26 is connected by a hydraulic line 28 to a slave hydraulic cylinder 27 mounted on the base frame 4. The piston 29 of this slave cylinder 27 is in contact with a plate 12 attached to the tilt frame 3.

As a misaligned belt 2 comes into contact with the servo rolls 6, the piston rod 25 is forced into the housing of master cylinder 26. This produces an increase in pressure in the hydraulic fluid which is transmitted, via the line 28, to the slave cylinder 27 which raises the piston 29 and in turn raises the proximal end of the tilt frame 3.

The hydraulic system described above can be replaced by an electrical servo motor system to achieve the same function.

In the embodiment of Fig. 8 one set of servo rolls 6 is attached to one end of a rod 30, and the opposite set of servo rolls 6 on the other side of the belt 2 is attached to the other end of the rod 30. The rod 30 slides in a sleeve 31 which is attached to the tilt frame 3, and has a linear gear tooth arrangement in the form of a gear rack 32. The gear rack 32 engages a gear 33 which is mounted to the tilt frame 3 and free to rotate about its axis. This gear 33 engages a curved gear rack 34 in the form of an arc which is concentric with the pivot axis of the pivot connection 5 between the tilt frame 3 and base frame 4. The curved gear rack 34 is attached to the base frame 4.

If the belt 2 misaligns to the right, the servo roll(s) 6, rod 30 and gear rack 32 are similarly moved to the right. This causes the gear 33 to rotate in a clockwise direction and climb up the curved gear rack 34, thus raising the right hand side of the tilt frame 3. Similarly if the belt misaligns to the left, the left end of tilt frame 3 is raised. In either case, a corrective tilting action is applied to the belt 2.

The gear 33 described above can be replaced by a sprocket and the gear racks 33, 34 by chains.

The foregoing describes a number of embodiments of the invention, and modifications which are obvious to those skilled in the art may be made thereto without departing from the scope of the invention as defined in the following claims. For example, the servo roll(s) could be replaced by other rotating or rolling element systems such as endless tracks, or any other servo member which does not substantially impede the longitudinal travel of the belt.

CLAIMS:

1. A training idler for a conveyor belt, comprising

a tilt frame having at least one roller on which the belt is adapted to run, the roller being rotatably mounted to the tilt frame,

at least one servo member adjacent each longitudinal edge of the belt,

tilting means for changing the orientation of the tilt frame and roller if the belt deviates laterally from a predetermined path, to thereby urge the belt in a direction opposite to the deviation,

characterised in that the tilting means is actuated by the physical urging of an edge of the belt against its adjacent servo member and in that the orientation is changed only by tilting the tilt frame and roller about an axis generally parallel to the direction of travel of the belt.

2. A training idler as claimed in claim 1, wherein the tilt frame is pivotally mounted on a base frame.

3. A training idler as claimed in claim 1, wherein each servo member is a roller rotatably mounted for free rotation about an axis generally orthogonal to the portion of the belt adjacent the servo member.

4. A training idler as claimed in claim 1, wherein two servo members are located adjacent each longitudinal edge of the belt, the two servo members being mounted on a support arm and each being freely rotatable about a respective axis generally orthogonal to the belt, the support arm being pivotable about an axis located intermediate the rotational axes of the two servo members and generally parallel thereto.

5. A training idler as claimed in claim 1, wherein the tilting means comprises a tilting mechanism located adjacent each end of the tilt frame, each tilting mechanism being responsive to movement of the servo member(s) at the near edge of the belt.

6. A training idler as claimed in claim 5, wherein

each tilting mechanism comprises an arm member pivotally mounted between its ends for pivotal movement about an axis generally parallel to the direction of travel of the belt, the servo member(s) at the near edge of the belt being mounted on one end of the arm member, and the other end of the arm member being subjacent the near end of the tilt frame, such that the physical urging of the belt against the servo member(s) causes the arm member to pivot and tilt the near end of the tilt frame upwardly.

7. A training idler as claimed in claim 5, wherein each tilting mechanism comprises a pivotally mounted arm member having the servo member(s) at the near edge of the belt mounted to an upper end thereof, the lower end of the arm member being connected to a generally wedge-shaped element located subjacent the near end of the tilt frame, such that the physical urging of the belt against the servo member(s) causes the arm member to pivot and drive the wedge-shaped element under the near end of the tilt frame, thereby tilting that end of the tilt frame upwardly.

8. A training idler as claimed in claim 2, wherein the tilting means comprises a tilting mechanism located at each end of the tilt frame, each tilting mechanism being responsive to the servo member(s) at the near edge of the belt, and wherein each tilting mechanism comprises an arm member pivotally mounted to the proximal end of the tilt frame, the arm member having the servo member(s) mounted at an upper end thereof and having its lower end adapted to abut the base frame when the arm member pivots, such that the physical urging of the belt against the servo member(s) causes the arm member to pivot and abut against the base frame to thereby tilt the proximal end of the tilt frame upwardly.

9. A training idler as claimed in claim 5, wherein each tilting mechanism comprises a lift member rotatable about an axis generally perpendicular to the belt, the lift member having a lower end resting on a support member which, in use, is fixed, at least one of the

abutting surfaces of the lift member and the support member being inclined to the horizontal, the lift member also having a lower arm extending radially therefrom with a portion located under the near end of the tilt frame, and an upper arm extending radially therefrom and having the servo member(s) mounted thereon, wherein in use, the physical urging of an edge of the belt against the servo member(s) causes the lift member to rotate and lift relative to its support member, and the lower arm thereby tilts the near end of the tilt frame upwardly.

10. A training idler as claimed in claim 9, wherein the lift member is screw threaded to the support member.

11. A training idler as claimed in claim 5, wherein each tilting mechanism is hydraulically operated and comprises a master cylinder operatively connected to the servo member(s), a slave cylinder located below the near end of the tilt frame, the master cylinder and slave cylinder being in fluid communication, whereby the master cylinder is responsive to the physical urging of the belt against the servo member(s) to cause the slave cylinder to raise the near end of the tilt frame.

12. A training idler as claimed in claim 2, wherein the tilting means comprises an elongate rack member juxtaposed with the tilt frame and slidable longitudinally, the rack member having the servo member(s) at opposite edges of the bolt mounted at opposite ends thereof, the rack member having a toothed portion in operative engagement with a pinion mounted on the tilt frame, the pinion being in operative engagement with a toothed portion of arcuate shape concentric with the pivot axis of the tilt frame, such that the physical urging of an edge of the belt against the servo member(s) at an edge of the belt displaces the rack member longitudinally to cause the pinion to rotate and travel relative to the fixed toothed portion and thereby raise the corresponding end of the tilt frame.

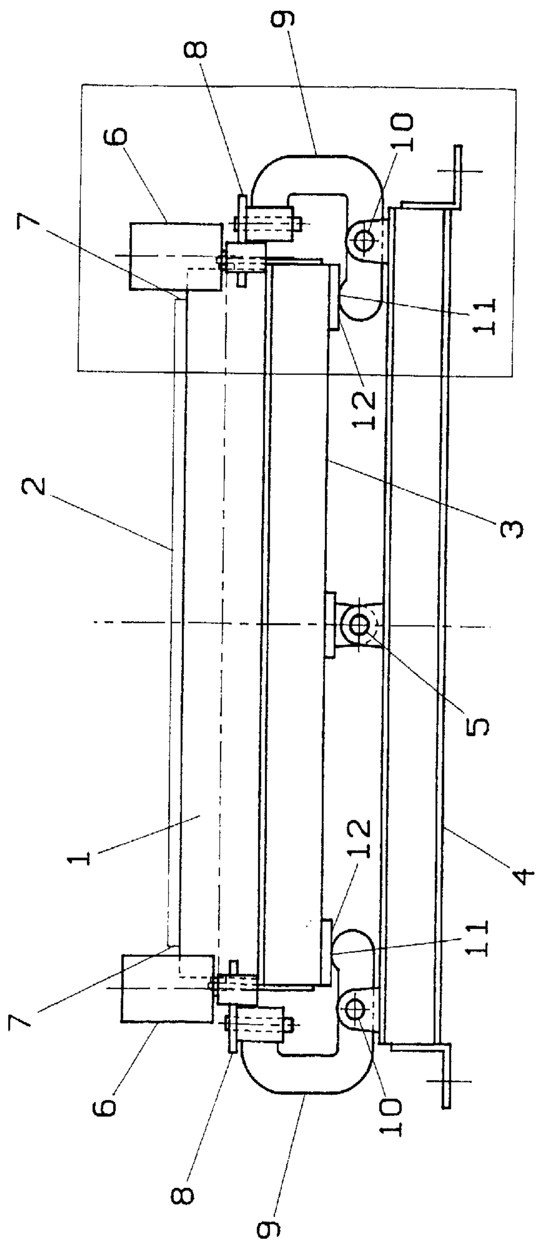


Fig.1

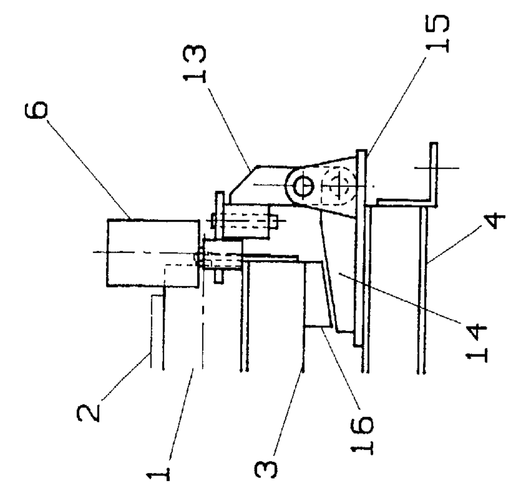


Fig.3

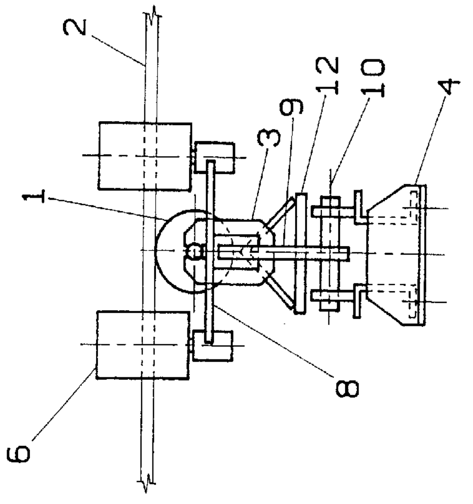


Fig.2

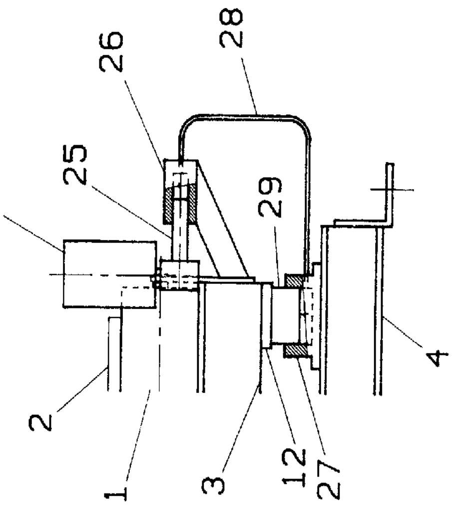


Fig.7

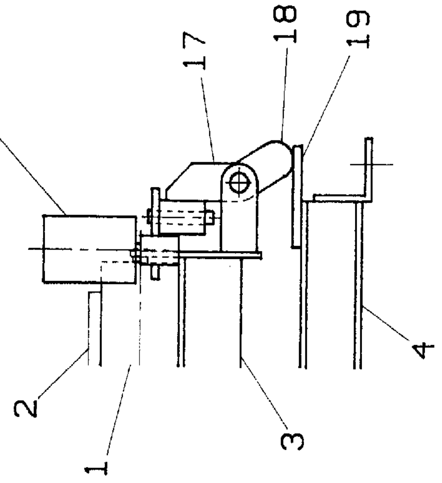


Fig.4

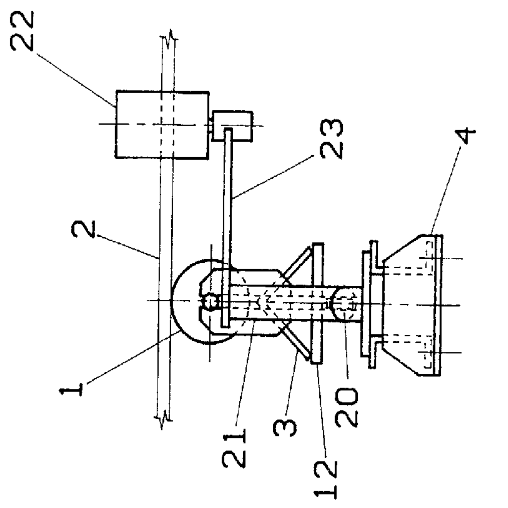


Fig.6

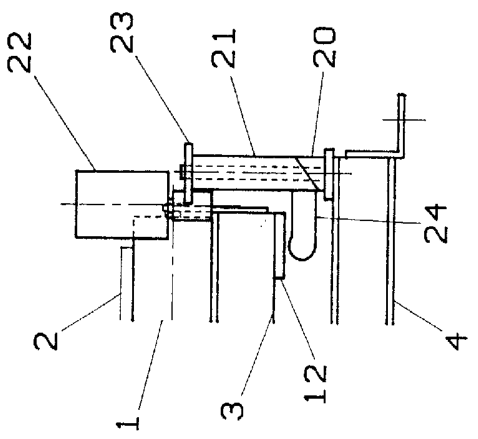


Fig.5

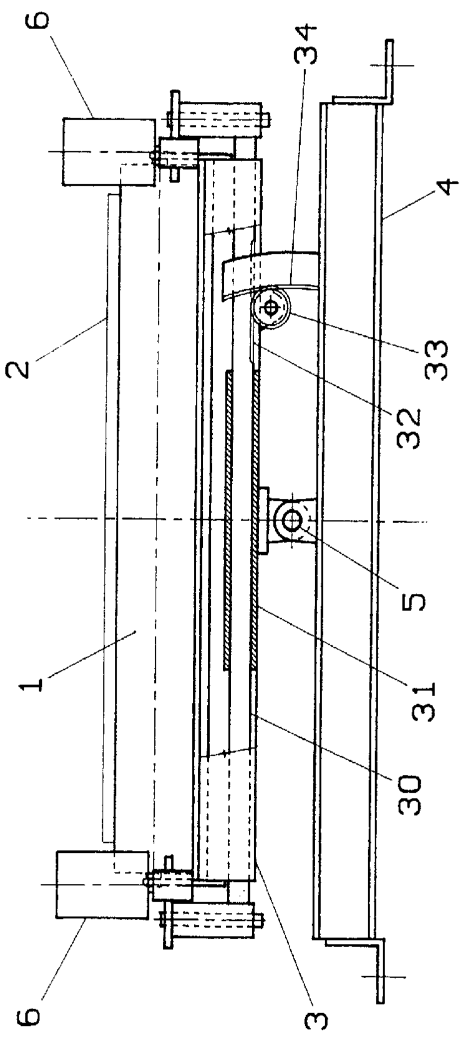


Fig.8