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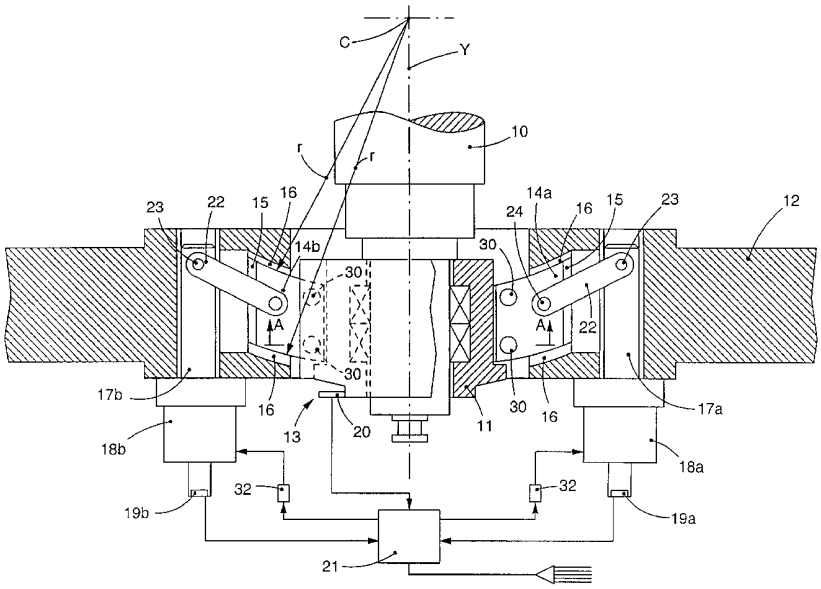
(54) Title: DEVICE TO VARY THE POSITIONING OF THE ROLLING ROLLS FOR PLANE PRODUCTS



(57) Abstract: A device to vary the positioning of a rolling roll (10) for plane products, comprising a housing (12) able to support the roll (10) and the respective chocks (11) thereof. On the crossing plane of the roll (10) and at the two sides of every chock (11) a drawing sector (14a, 14b) is provided for cooperating with drive means (17a, 17b, 18a, 18b), and a transmitter element (22) is present in an intermediate position to achieve an oscillating connection between the drawing sector (14a, 14b) and the drive means (17a, 17b, 18a, 18b), which are associated with position transducer means (19a, 19b) and data processing means (21).

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DEVICE TO VARY THE POSITIONING OF THE ROLLING ROLLS FOR PLANE PRODUCTS

* * * * *

FIELD OF THE INVENTION

The invention concerns a device to vary the positioning of the rolls, that is, crossing the rolls in a rolling stand for plane products, such as sheets, large plates or similar.

BACKGROUND OF THE INVENTION

In the state of the art, a problem which has not been correctly solved is that the drawing sectors are not displaced congruently, according to corresponding points, with the drawing sectors of the chock if the axes remain correspondent.

JP-A-57195513 discloses a device to perform a cross section of rolls smoothly, by providing chock holding devices to both sides of the roll chocks along a rolling direction and by rocking both rocking pieces of the devices to opposite directions by equal quantities respectively by making the eccentric pins as the rocking centers. In particular, two jacks are actuated respectively in opposite directions by equal quantities. At the side of a first jack, the movement of the latter is transmitted to a corresponding eccentric pin through a slide block, a link, a lever, and a rotary shaft; at the side of a second jack, the movement of it is transmitted to another corresponding eccentric pin in the same manner. Accordingly the two eccentric pins are rotated respectively in opposite directions by equal quantities to move rocking pieces in opposite directions by equal quantities respectively. Against the movements of such rocking pieces at an operation side, rocking pieces at a driving side move reversely to the operation side, and in opposite direction by the same quantity respectively in order to make the roll axis cross an horizontal imaginary

line which intersects the rolling direction perpendicularly. This known device is complicated and cumbersome due to the use of eccentric means.

SUMMARY OF THE INVENTION

The invention is intended to solve this problem and to supply other advantages.

With the inventive idea of this invention, the displacements of the drawing sectors are congruent, for corresponding points, with those of the chocks (same axis of rotation). The action of the bending means of the rolls, both in and out, on the wings of the chocks, is exerted in the same position for any value whatsoever of the crossing angle α.

In this way there is no relative sliding between the bending rolls and chock, during the movement caused by a variation in the crossing angle α. This also allows to maintain the bending load at very high values, during said movement. As can be seen in Figs. 2a and 2b, despite the variation in the crossing angle α, the relative position of the bending rolls with respect to the chock remains the same. Each bending roll is not therefore subject to thrusts perpendicular to its axis, caused by friction; it is therefore possible to have:

- a high level of bending during the variation in the crossing angle α;
- greater reliability of the whole mechanism of the bending rolls;
- shorter bending rolls, with less vertical bulk, as it is not necessary to have a long "guide" to support the torque generated by $\mu F_{bending} \cdot b$ (Fig. 3), since said torque is nil, since $\mu F_{bending}$ is equal to zero when there is no movement between chock and bending rolls.

The drive means are arranged both on the side of the

operator and on the command side on the outer faces of the housings, so that there is no bulk on the extrados of the housings; this bulk would complicate access to the inter-stand, particularly in the case of a tandem positioning with two or more stands.

The multiplier effect of the transmitter element allows to vary the crossing angle under load, with limited dimensions of the drive means.

The reversible kinematism prevents movement from being blocked in the event of a malfunction of the line transducers or the control system which processes a geometric model of the kinematism, to give the position references to the actuator, which can be electric, electro-mechanical or hydraulic. The reversible kinematism allows to prevent the mechanism from blocking and consequent anomalous overloads between the different elements of the mechanism.

The friction load on the kinematic chain has a deadening effect on any possible vibrations which, without said friction, could occur on the horizontal plane too, induced by the rolls connected to the chocks.

The independent drive of the four sectors, two on the operator side and two on the engine side, allows to make the roll change with an adequate play between chock and stand housing.

According to the invention, the two chocks are made to cooperate, on the crossing plane, with two plus two drawing sectors.

Said two plus two drawing sectors are located respectively one upstream and one downstream of the specific chock.

Each drawing sector moves in linear fashion and is connected by means of a transmitter element to a substantially linear drive and feed means. According to a variant, the drawing sector moves in a curve.

The axis of displacement of said drive means is substantially parallel to the nominal axis of the roll.

According to a variant, said axis of displacement is angled with respect to said nominal axis.

According to another variant, the feed of the drive means determines a trajectory with a linear-curved path.

According to the invention, the transmitter element is a tie-strut element.

The axis of said tie-strut element is inclined on the crossing plane with respect to the normal to the nominal axis of the roll.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other characteristics of the invention will become clear from the following description of a preferred form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

Fig. 1 is a partly sectioned view from above of the device to vary the positioning of the rolls according to the invention;

Figs. 2a and 2b are schematic views of two different working positions of the device shown in Fig. 1;

Fig. 3 is a schematic view of a first detail of the device in Fig. 1;

Fig. 4 is a schematic view of a second enlarged detail of the device in Fig. 1;

Fig. 5 is a section from A to A of Fig. 1.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

We shall now describe, with reference to the attached Figures, a practical embodiment of the inventive idea, given as a non-restrictive example.

Fig. 1 is a view from above of a terminal part of the rolling roll 10, which can be a working roll or an intermediate roll, with the relative chock 11. The other

terminal part of the roll 10 is substantially specular.

Said terminal part cooperates with the housing 12 of the rolling stand which has the intermediate compartment 13 vertical, where the chock 11 is housed.

On the chock 11, on one side and the other of the crossing plane of the roll 10, two drawing sectors 14a and 14b are provided.

The drawing sectors 14a and 14b in this case cooperate with a seating 15 in the housing 12, equipped with anti-friction sliding cylindrical surfaces 16, the radii r of which have their center at a point C arranged along the axis of rotation Y of the roll 10 and in correspondence with the center line of the latter.

On every side of the chock 11, and in coordination with the respective drawing sector 14a, 14b there is a drive means 17a and 17b which, in this case, is connected to an actuator consisting of a hydraulic cylinder jack 18a and 18b. The jack 18a, 18b can also be of the electric or electro-mechanical type.

Each jack 18a, 18b is connected to a position transducer 19a and 19b.

With each chock 11 four bending rolls 30 can advantageously be associated; these can be actuated by any conventional means, for example by jacks 31 located in the drawing sectors 14a and 14b (Fig. 5). The jacks 31 can be single effect (of the IN or OUT type, or the IN+OUT type), or double effect, with a hammer head.

According to the invention, also the chock 11 or other part of the chock-roll assembly, is equipped with a position transducer 20.

The various transducers 19a, 19b and 20 located in relation to the two housings 12 - chocks 11 are connected to a processing unit 21 which, by means of electro-valves 32 or

similar, governs the position of the jacks 18a, 18b and therefore of the drive means 17a, 17b.

The drive means 17a, 17b are connected to the respective drawing sector 14a, 14b by two levers 22 oscillating in the stoppers 23 and 24.

The two levers 22, in this case, are inclined with respect to the normal to the nominal axis of the roll 10, by an angle β (Fig. 4) of between about 10° and 45°, advantageously between about 15° and 30°.

According to the invention, the drawing sectors 14a, 14b and the facing associated chocks 11 of the same roll 10 move in arcs of a circle with their center at C.

The crossing of the roll 10 is made by means of four drawing sectors 14a, 14b, two for each chock 11, (only two are shown in Fig. 1), which are guided in their arched displacement, by the cylindrical guides 16 arranged concentric with the axis of rotation passing through the point C and perpendicular to the axis Y. The displacements of the four sectors 14a, 14b are antisymmetric and two by two, of the opposite sign on the two chocks 11 and of the same entity.

In this case, each jack 18a, 18b is arranged parallel to the axis of rotation Y of the roll 10. Each jack 18a, 18b is able to axially displace the corresponding drive means 17a, 17b consisting of a pin guided prismatically on the housing 12.

Each lever 22, hinged on the pin 17a, 17b and the sector 14a, 14b, as its angular lay-out varies, is able to displace the latter in the arc of a circle. The crossing of the roll 10 around the nominal axis Y, with center at C, is obtained by coordinating the actuation of the four jacks 18a, 18b which are controlled in position by the respective transducers 19a, 19b.

The angular position of each lever 22 is such as to generate on the actuator an axial thrust $F_1 \sin\beta$ (Fig. 4) of more than $\mu F_1 \cos\beta$ and of a value such as to be detected by the system which controls the actuator. That is to say: $F_1 \sin\beta > \mu F_1 \cos\beta$ or $tg\beta > \mu$ with a margin such that the residual force on the actuator ($F_1 \sin\beta - \mu F_1 \cos\beta$) has values such as to be detected by the actuator (that is, to make the actuator yield).

Otherwise there is a risk of "breaking" the lever 22 or other elements of the kinematic chain, like the pins or otherwise.

Thanks to the fact that the drawing sectors 14a and 14b move in arcs of a circle with the center at C, and that the chock 11 also moves in arcs of circle with the center at C, the bending rolls 30 never slide with respect to the chock 11, with the advantages explained above. In this way, moreover, the roll 10 can be crossed with the bending forces kept applied; it is therefore not necessary to reduce the bending forces to zero before crossing the roll 10, whether it be a working roll or an intermediate roll.

It is obvious that modifications or additions can be made to the device as described heretofore without departing from the spirit and scope thereof. It is also obvious that, although the description refers to a specific example, a skilled person shall certainly be able to achieve many other equivalent applications of the device described above, all of which shall come within the field and scope of this invention.

CLAIMS

1 - Device to vary the positioning of at least a rolling roll (10) for plane products, comprising a housings (12) able to support said roll (10) and the respective chocks (11), characterized in that on the crossing plane of said roll (10) at least one drawing sector (14a, 14b) is connected to the corresponding side of every chock (11) for cooperating with corresponding drive means (17a, 17b, 18a, 18b), in that a transmitter element (22) is disposed in an intermediate position between said drawing sector (14a, 14b) and said drive means (17a, 17b, 18a, 18b) to achieve an oscillating connection between said drawing sector (14a, 14b) and said drive means (17a, 17b, 18a, 18b), in that said drive means (17a, 17b, 18a, 18b) have a linear axis of displacement substantially parallel to the nominal axis (Y) of the roll (10), and in that said drive means (17a, 17b, 18a, 18b) are associated with position transducer means (19a, 19b) and with data processing means (21).

2 - Device as in claim 1, characterized in that at least a portion of said drive means (17a, 17b, 18a, 18b) is disposed outside said housing (12).

3 - Device as in claim 1 or 2, characterized in that said drawing sector (14a, 14b) is able to move according to a curve coherent with the vertical axis of the chock (11).

4 - Device as in claim 3, characterized in that said curve comprises an arc of a circle with the center at a point (C) arranged along the nominal axis of rotation (Y) and in correspondence with the center line of said roll (10).

5 - Device as in claim 4, characterized in that the crossing of said roll (10) is achieved by means of four drawing sectors (14a, 14b), two for each chock (11), which are guided in their arched displacement by cylindrical guides (16) having an axis of rotation passing through said point (C) and

perpendicular to the axis of rotation (Y) of said roll (10).

6 - Device as in claim 5, characterized in that the displacements of said four sectors (14a, 14b) are two by two and antisymmetric, of the opposite sign on the two chocks (11) and of equal entity.

7 - Device as in claim 6, characterized in that said drive means comprise, for each of said four sectors (14a, 14b), a jack (18a, 18b) arranged parallel to the axis of rotation (Y) of the roll (10) and a pin (17a, 17b) guided prismatically on the corresponding housing (12).

8 - Device as in claim 7, characterized in that said transmitter element comprises a lever (22) hinged on the pin (17a, 17b) and on the corresponding sector (14a, 14b) and able, as its angular lay-out varies, to displace said sector (14a, 14b) according to said arc of a circle.

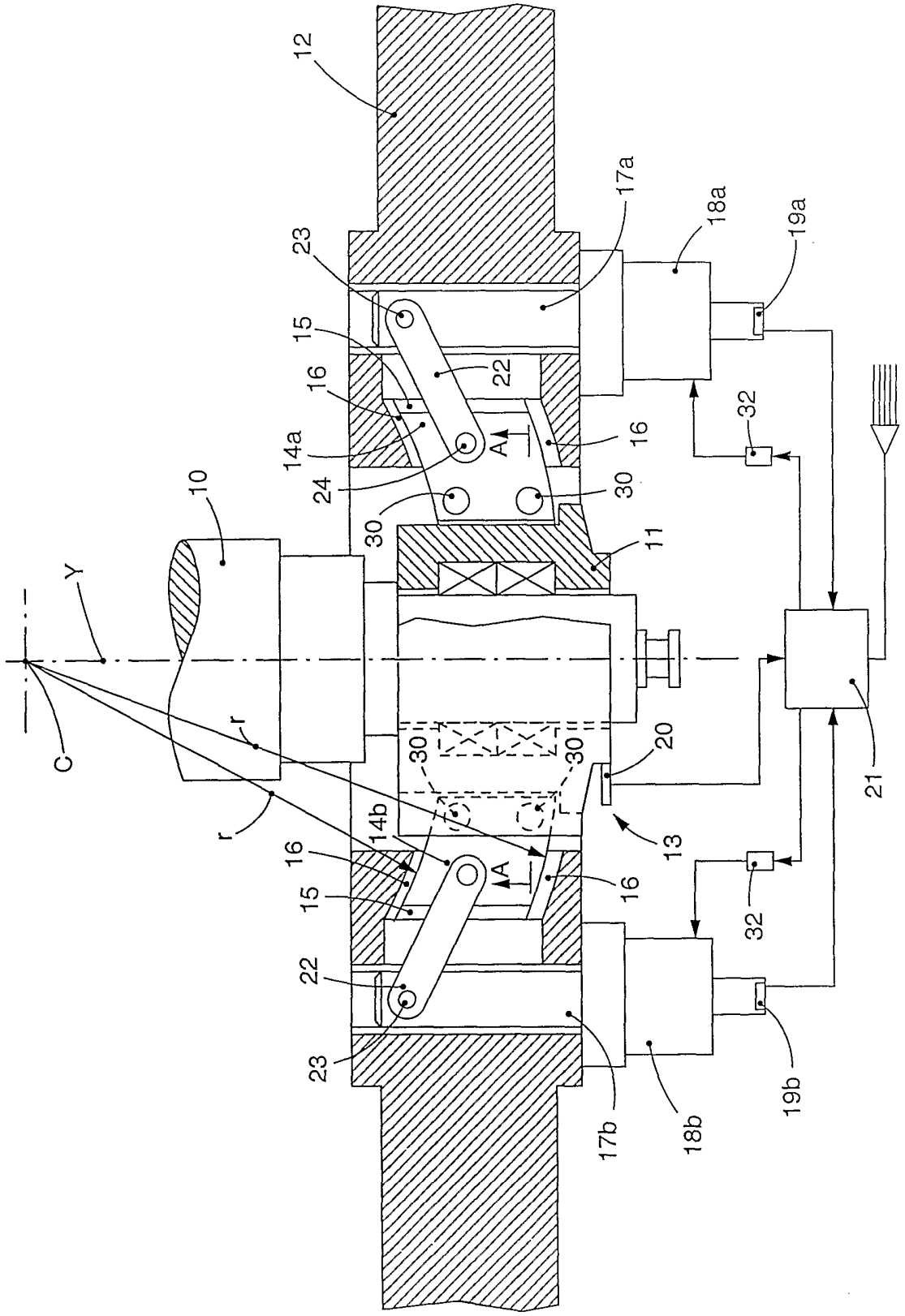
9 - Device as in claim 8, characterized in that each lever (22) is inclined, with respect to the normal to the axis (Y) of the roll (10), by an angle (β) of between about 10° and 45°, advantageously between about 15° and 30°.

10 - Device as in claim 1, characterized in that said drawing sector (14a, 14b) contains actuating means (30, 31) to actuate the bending of said rolling roll (10), so that every bending force applied by said means (30, 31) to actuate the bending can be maintained during the crossing of said rolling roll (10).

11 - Device as in claim 10, characterized in that said actuating means comprise at least a jack (31) positioned in said drawing sector (14a, 14b).

12 - Device as in claim 11, characterized in that said jack (31) has a single effect, either of the IN or OUT type, or of the IN plus OUT type.

13 - Device as in claim 11, characterized in that said jack (31) has a double effect, with a hammer head.


12
17a
18a
19a
23
15
16
22
14a
24
A
16
30
30
32
10
11
Y
C
r
r
30
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20
14b
16
15
16
A
13
32
22
23
17b
18b
19b
21

fig. 1

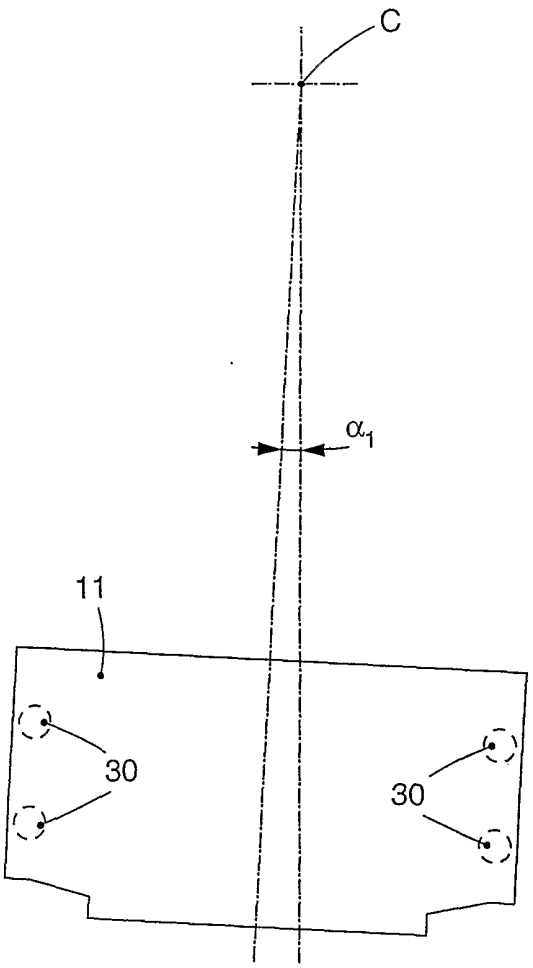

fig. 2a

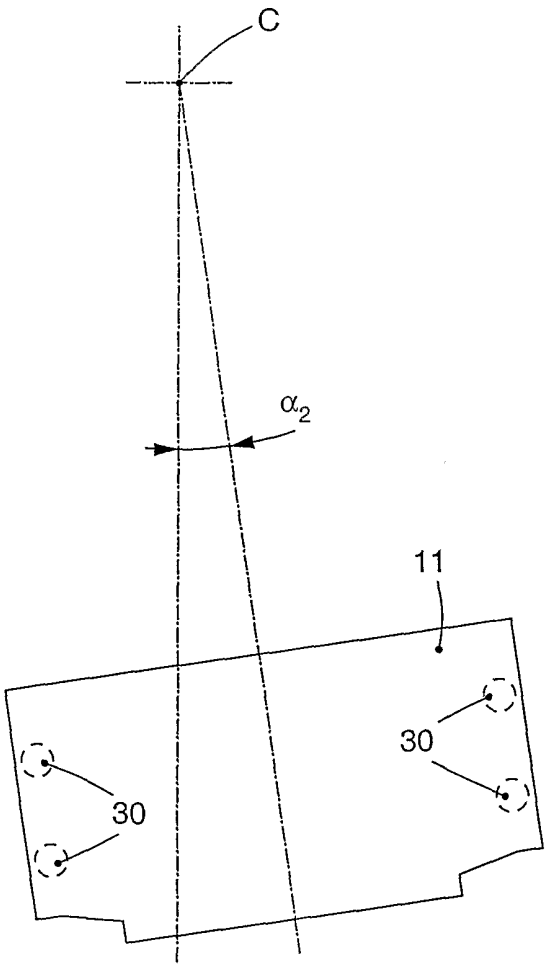

fig. 2b

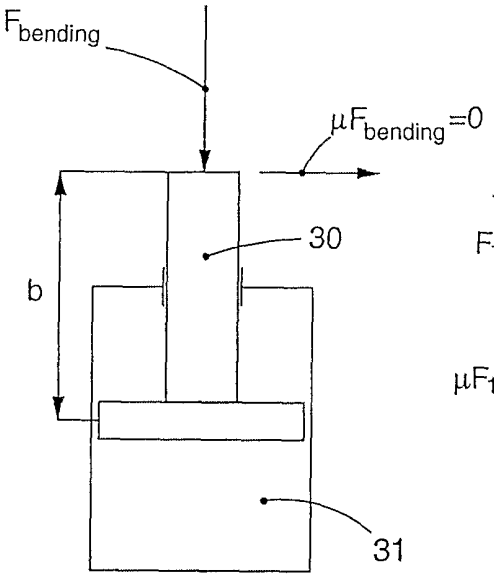

fig. 3

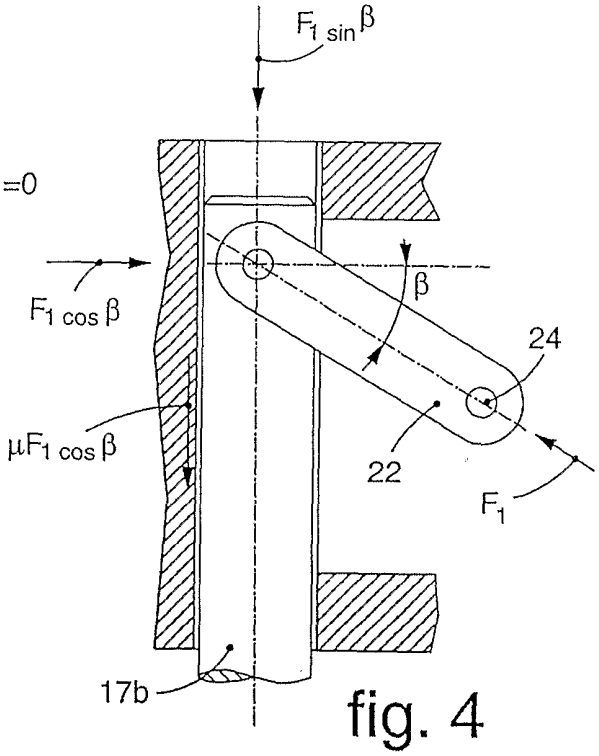

fig. 4

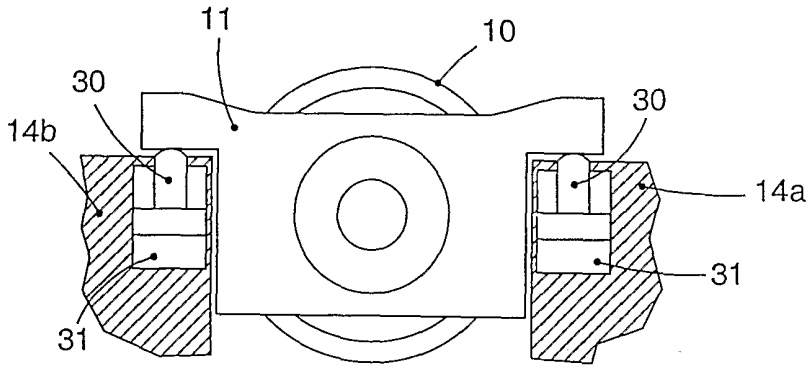

fig. 5

INTERNATIONAL SEARCH REPORT

International Application No
../IB 01/01737

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B21B13/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 007, no. 047 (M-196), 24 February 1983 (1983-02-24) -& JP 57 195513 A (MITSUBISHI JUKOGYO KK;OTHERS: 01), 1 December 1982 (1982-12-01) cited in the application abstract; figures	1-9
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
13 December 2001	21/12/2001

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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