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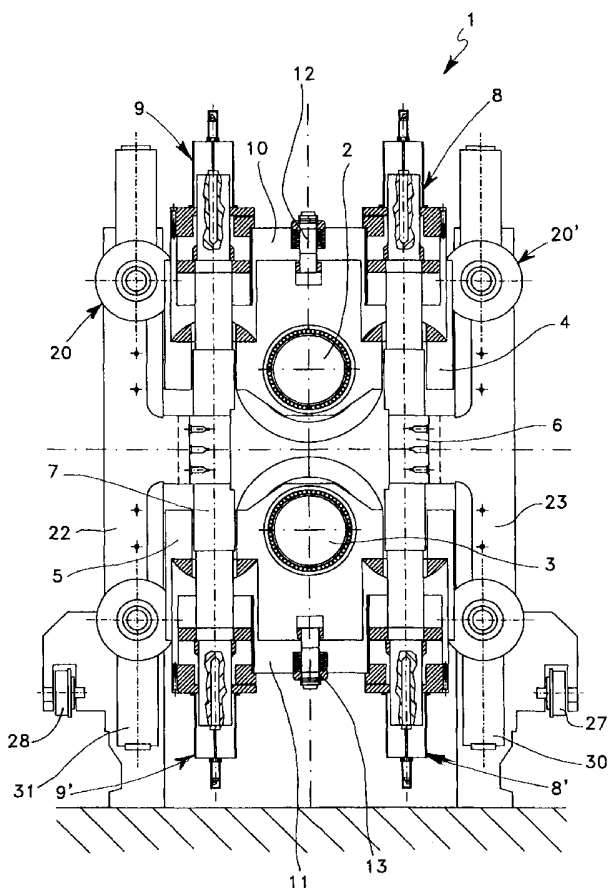
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(54) Title: UNIVERSAL ROLLING STAND WITH ROLL GAP CONTROL



(57) Abstract: A universal rolling stand with control of the space between the rolls comprises a pair of horizontal rolls and one or more vertical rolls with respective chocks, positioning housings and a guide for the chocks with adjustment tie rods (6, 7, 6', 7', 18, 18', 19, 19') anchored on one side to the housings and acting on the chocks for the adjustment and positioning of the rolls. Adjustment is performed by means of hydraulic capsules (8, 8', 9, 9', 20, 20', 21, 21') with two hydraulic chambers with dual actuation effect and a double stem at the ends of each tie rod.

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Universal rolling stand with roll gap control

Field of the invention

The present invention refers to a process and to a universal rolling stand with roll gap control.

5 Prior art

Universal rolling stands are used principally in the production of rolled sections with bent edges and of T-beams, H-beams, etc. Universal rolling stands are generally composed of a pair of rolls with a horizontal axis and one or two rolls with a vertical axis placed on one side or on both sides of the horizontal axis rolls.

10 One type of universal rolling stands of the prior art comprises a roll supporting structure composed of two monobloc connecting elements parallel to the axes of the horizontal rolls which join together the side housings of the stand. The housings in turn support the chocks which comprise the bearings for the support and rotation of the horizontal axis rolls. Instead, the vertical axis rolls are fitted in
15 chocks placed between the columns of the housings, between the chocks of the horizontal axis rolls.

One of the problems that must be solved in this type of stands is how to find the right compromise between the rigidity of the structure of the stands reacting to the forces generated during the rolling operations, their lightness and their simplicity of
20 construction in order to allow maintenance operations and the replacement of worn parts of the stands or of the whole stands in the shortest possible time so as to reduce down times.

In the past, to accelerate roll changing or maintenance operations, as well as to reduce the time necessary to change the rolling stands, various types of solutions
25 have been proposed.

The Italian patent document IT-UD92A000110 describes a universal rolling stand with housings composed of common elements with a threaded spindle which ensure the regulation of the distance between the centres of the rolls. In this stand the rotating movement of the threaded spindle is transformed into a traverse
5 movement of the supports which hold the chocks of the horizontal rolls.

The patent document IT-UD92A000022 describes a system for adjusting the closure of the vertical rolls which can be fitted in a universal stand in combination with the support structure for horizontal rolls described in IT-UD92A000110.

The patent US-A-4.918.964 describes a universal stand equipped with systems for
10 roll gap adjustment of a hydraulic type. The hydraulic cylinders have a single effect and one is applied for each of the chocks of the upper horizontal roll and for each of the vertical rolls.

The main problem presented by these types of stand is that of reducing the strain which is produced under load, remaining within the limit of the tolerances
15 requested by the processes which must be carried out by these types of stand.

The most common strains occurring in these types of stand are those deriving from the variation of the roll gap, caused by the deformation of the elastic elements that make up the stand, during lead-in of the bar and the release of the bar itself.

20 Summary of the invention

The main purpose of the present invention is to overcome the drawbacks described above, by providing a universal rolling stand with roll gap control and which presents an increased rigidity and improved dynamic performances.

Another purpose of the invention is to provide a stand of the above-mentioned

type which allows decreased wear of its components, reduction of the number and type of manual operations, and a simplification of the structure.

These aims, along with others which will become apparent in the following description, are achieved by means of a universal rolling stand with roll gap control
5 having the features of claim 1.

Thanks to these features in the universal rolling stand, the two pairs of vertical tie rods which support the rolling load have a reduced length and reduced extensions because the hydraulic working chambers relative to the horizontal rolls are placed very close to the axis of the rolls themselves. The arrangement of the working
10 chambers provided for in the new universal stand allows the load generated during rolling to be closed in a shorter path than with traditional rolling mill stands with housings that form a closed loop of forces. In general it results in an increased rigidity of the whole stand.

Thanks to a particularly advantageous embodiment of the stand according to the
15 invention, a spherical joint placed between the connecting cross members of the actuating cylinders, solidarily with the latter, and the chocks of the horizontal rolls, allows the chocks to tilt about the axis of the tie rods. In this way, even when the rolls are subjected to the rolling load and the chocks tend to tilt, the tie rods remain straight. In this way only axial loads are exerted on the actuating cylinders,
20 but not radial loads, with the result of increasing the duration of the gaskets of the actuating cylinders themselves.

In comparison with the traditional solutions which use stay bolts that rotate around their own axis for regulating the centre distance of the rolls, the hydraulic actuating cylinders allow the use of non rotating bolts or tie rods. This offers the advantages

that the tie rods may be made with an enlarged diameter with a square section in their central area, which further increases the rigidity of these elements. Moreover the gaskets associated with the tie rods are all subjected to static stresses, so their efficiency and duration are increased with respect to the rotating gaskets
5 used in other known solutions.

The use of double acting hydraulic actuators with a double shaft allows an improvement of the dynamic performance of the stand because the actuator response and adjustment times at lead-in and release of the bar are considerably reduced and the tolerances that can be obtained on the product are improved.
10 Further advantages connected to the use of actuating cylinders consist of the fact that the rigidity of the double acting actuating cylinder is double that of the single-acting cylinder and that the additional external balancing rolls and their respective hydraulic controls have been eliminated.

The use of hydraulic actuating cylinder on the support according to the invention,
15 located in correspondence to the tie rods also avoids problems due to peak loads. This is because the tie rods always work under traction and never under compression, as happens instead in stands with closed housings of the prior art, where the strokes must be reduced due to the occurrence of peak load instability. Consequently it is not necessary to insert shims between actuating cylinder and
20 chocks to cover the whole interval of values that the roll centre distance can assume,

Thanks to the feature which also provides for a mechanical preload by means of springs, it is possible to eliminate the clearance between spherical joint and chock. In a particular embodiment, the preload in a spherical joint is also provided to

allow the oscillation of the chock and the preloading is adjustable so as to balance adequately the weight of roll and chock.

The double acting hydraulic actuators with double stem have sections with slightly different dimensions in the two working chambers so that, in the case of an emergency, the space between the rolls is automatically opened by the emergency hydraulic circuit

In a preferred embodiment of the invention, since the stand has a modular structure and automatic or semiautomatic hydraulic controls, it needs less intervention of human operators with reduction of risks for the safety of the latter.

10 The stand structure is much simplified, too.

In the stand according to the invention, certain manual operations are eliminated and others are reduced or simplified and automated so that the time for changing the rolls is much shorter than with other stands of the prior art.

Another advantage of the invention consists of the fact that the use of hydraulic actuating cylinders in the universal stands according to the invention allows an independent regulation of the roll, for example between the upper horizontal roll and the lower horizontal roll. This is particularly important, above all when rolling beams with sections not symmetrical with respect to the horizontal axis.

Brief description of the figures

20 Further characteristics and advantages of the invention will become apparent from the detailed description of a preferred, but not exclusive embodiment of a universal rolling stand with roll gap control, illustrated hereafter by way of a non-limiting example with the aid of the enclosed drawings in which:

Fig. 1 represents a section along a plane orthogonal to the axes of the horizontal

rolls of a universal rolling stand according to the invention,

Fig. 2 represents a cross section of an element of the stand of Fig. 1,

Fig. 3 represents a side view of another element of the stand of Fig. 1,

Figures 4, 5, 6 represent plan views of elements of the stand in Fig. 1,

5 Description of a preferred embodiment

With particular reference to the figures mentioned, the universal rolling stand globally indicated with the reference numeral 1 comprises two rolls with horizontal axis 1, 3, mounted on four chocks 4, 5, two for each of the horizontal rolls, of which only the ones placed at one side of the stand are visible in figure 1. The other two chocks placed on the hidden side of the stand in figure 1 are perfectly identical to the previous ones and are not further described in detail.

On each side of the stand are placed two vertical tie rods 6, 6', 7, 7' which fix the two chocks 4, 5 of the horizontal rolls 2, 3. On each of the two tie rods 6, 7 are fitted two hydraulic actuating cylinders 8, 8', 9, 9', one near the upper roll 2 and the other near the lower roll 3.

The four tie rods of the stand 1, both of the part on view and of the hidden part, are fixed and cannot turn around their own axis, unlike the stay bolts of prior art stands.

On each side of the stand 1 there are two cross members 10, 11, one at the top and the other at the bottom of the stand, each connecting two respective actuating cylinders 8, 9 e 8', 9'. The upper cross member 10 acts as a support for the upper chock 4 and the lower cross member 11 for the lower chock 5, in both cases with the aid of a respective ball joint 12, 13. Springs or hydraulic devices for eliminating the clearance that can be produced in the connections with the respective cross

members may be placed advantageously next to the ball joint.

The stand also comprises two rolls 14, 15 with a vertical axis, better represented particularly in Figures 4 and 6, and also mounted on a respective chock 16, 17, one for each of the rolls. Next to each vertical roll are placed two respective tie
5 rods 18, 18', 19, 19', which also do not rotate around their own axis. On each of the tie rods 18, 18', 19, 19' there is fitted a respective hydraulic actuating cylinder 20, 20', 21, 21' of the same type as those used on the tie rods of the horizontal rolls.

The tie rods of the vertical and horizontal rolls are connected together by four
10 housings 22, 23, 24, 25, two of which are placed on the control side and two on the operator side, on which the tie rods are fixed. The housings are advantageously provided with trolleys 30, 31 sliding on guides to facilitate the movement of the housings and their handling during assembly and dismantling of the stand 1.

15 The stand 1 is completed by a basket 26 for supporting the rolls and the guides. Also the basket 26 is advantageously provided with trolleys 27, 28 to facilitate the movement of the whole stand 1.

The actuating cylinders used in the stand 1 according to the invention are composed of two double acting hydraulic chambers 32, 33 with a double rod
20 separated by an intermediate piston 34 where the oil under pressure is sent to the two chambers in a suitable way to balance the rolling forces.

The main parts that make up the stand are the housings and the chocks for the horizontal and vertical rolls on the control side (LC), the housings and the chocks for the horizontal and vertical rolls on the operator side (LO) and the sandwich

holding basket with a trolley, which in turn comprises the horizontal rolls, the vertical rolls with respective support, the equipment holding bars and the rolling guides. These parts can move appropriately, moving close together and opening hydraulically, sequentially and semi-automatically to perform the operations of

5 replacing both the vertical and the horizontal rolls.

The equipment holding bars are joined to the housings LC and LO with 4 tie rods 35, 36 which are blocked with hydraulically controlled wedges and pre-tensioned with hydraulic brackets, not illustrated in detail in the figures.

CLAIMS

1. Universal rolling stand with roll gap control comprising a pair of upper (2) and lower (3) rolls, with a horizontal axis defining a rolling plane, said rolls being associated with respective chocks (4, 5), and at least one roll with a vertical axis (14, 15), provided with its own positioning and guiding chock (16, 17), said stand comprising moreover a number of housings (22, 23, 24, 25) for the positioning and guiding of said chocks and a number of tie rods (6, 7, 6', 7', 18, 18', 19, 19') anchored at one side to said housings and at the other side operatively connected to said chocks, characterised in that said tie rods are associated with means for regulating and positioning the chocks composed of double acting hydraulic actuating cylinders (8, 8', 9, 9', 20, 20', 21, 21') placed at least one end of one or more of said tie rods (6, 7, 6', 7', 18, 18', 19, 19').
2. Rolling stand according to claim 1, wherein four of said tie rods (6, 7, 6', 7'), each of which being provided with a pair of hydraulic actuating cylinders (8, 8', 9, 9') each of which being placed at one end of the respective tie rod, are adapted for regulating and positioning the rolls with horizontal axis.
3. Rolling stand according to one of the previous claims, wherein other four of said tie rods (18, 19, 18', 19'), each of which being provided with a hydraulic actuating cylinder (20, 20', 21, 21') placed at one end of the respective tie rod, are adapted for regulating and positioning the rolls with vertical axis .
4. Rolling stand according to one of the previous claims, wherein each chock (4, 5, 16, 17) of the rolls with vertical axis or with horizontal axis is provided

with a pair of hydraulic actuating cylinders (8, 8', 9, 9', 20, 20', 21, 21').

5. Rolling stand according to claim 4, wherein the pairs of hydraulic actuating cylinders associated with each chock of the rolls with horizontal axis are connected by means of connecting cross members (10, 11) acting as a support for the chock itself.
6. Rolling stand according to claim 5, wherein between the connecting cross members (10, 11) and the respective chocks of the rolls with horizontal axis, there are placed ball joints (12, 13).
7. Rolling stand according to claim 6, wherein in correspondence of said ball joints there are placed springs or hydraulic devices for eliminating the clearance present in said joints.
8. Rolling stand according to one of the previous claims, wherein there is provided control means for the independent regulation of the hydraulic chambers of said actuating cylinders.
9. Rolling stand according to one of the previous claims, wherein said hydraulic actuating cylinders are adapted for hydraulic balancing of at least one roll of said stand.
10. Rolling stand according to one of the previous claims, wherein said hydraulic actuating cylinders have a double stem.
11. Rolling stand according to one of the previous claims, wherein there are provided two rolls with vertical axis (14, 15).
12. Rolling stand according to one of the previous claims, wherein there are provided four housings (22, 23, 24, 25) two of which being placed on the control side and two of which on the operator side, equipped with trolley

(30, 31) sliding on guides.

- 13 Rolling stand according to one of the previous claims, wherein said stand is equipped with a basket (26) provided with trolleys (27, 28), for supporting the rolls with horizontal axis and the guides during the assembly
5 /disassembly stages of the stand.
- 14 Rolling stand according to one of the previous claims, wherein one or more of the hydraulic double acting actuating cylinders are provided with two respective hydraulic chambers of slightly different sections.

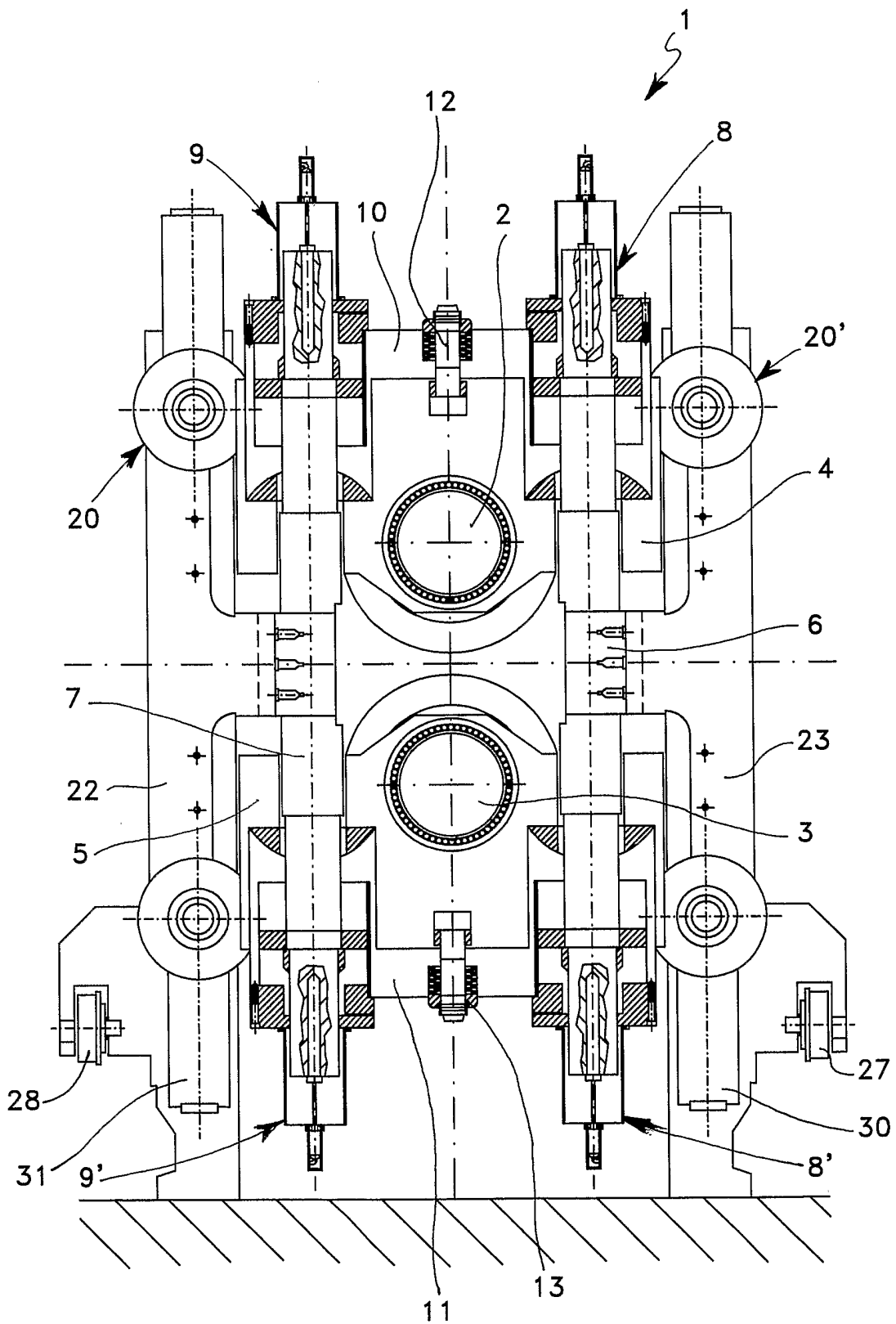


Fig. 1

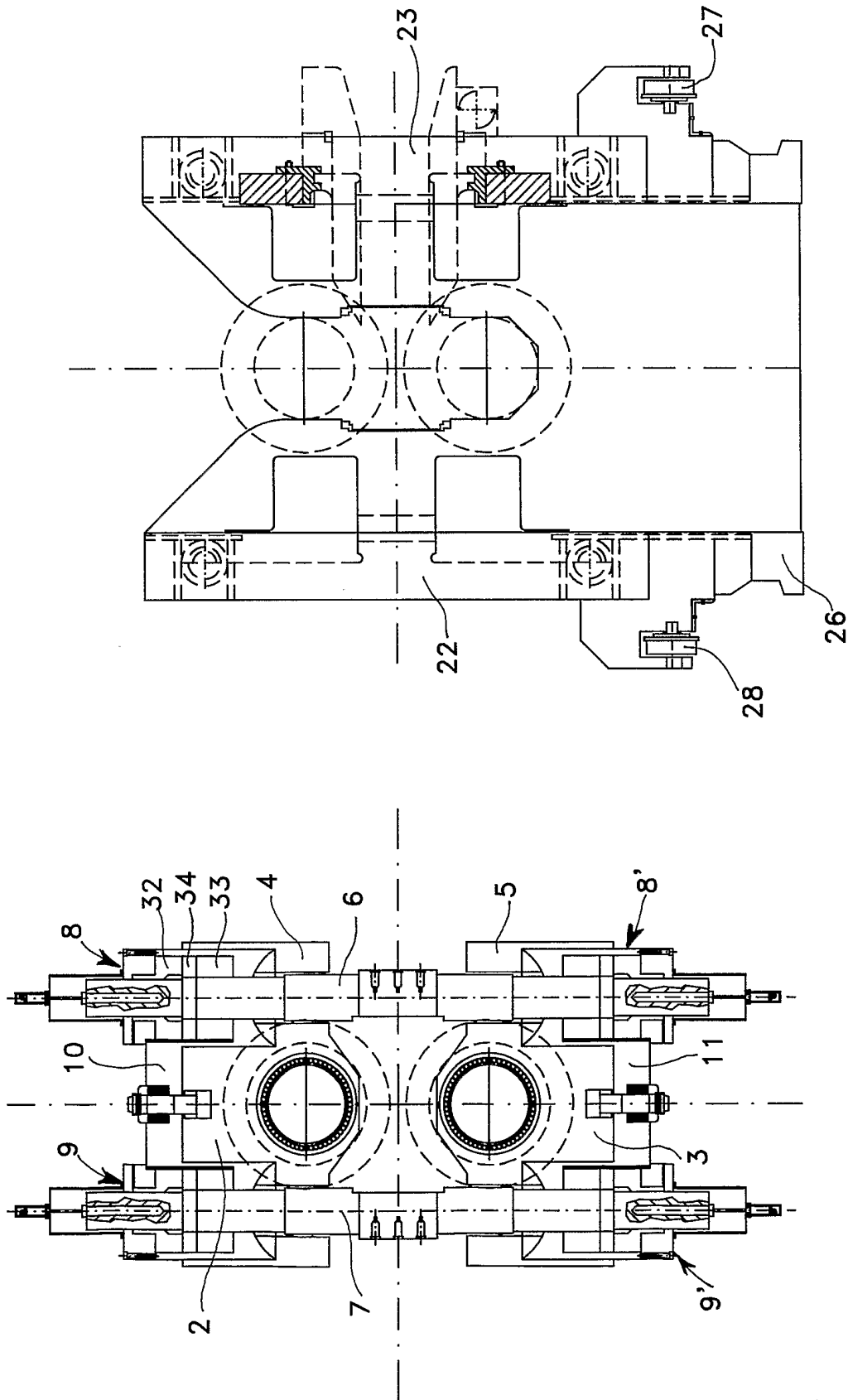


Fig. 3

Fig. 2

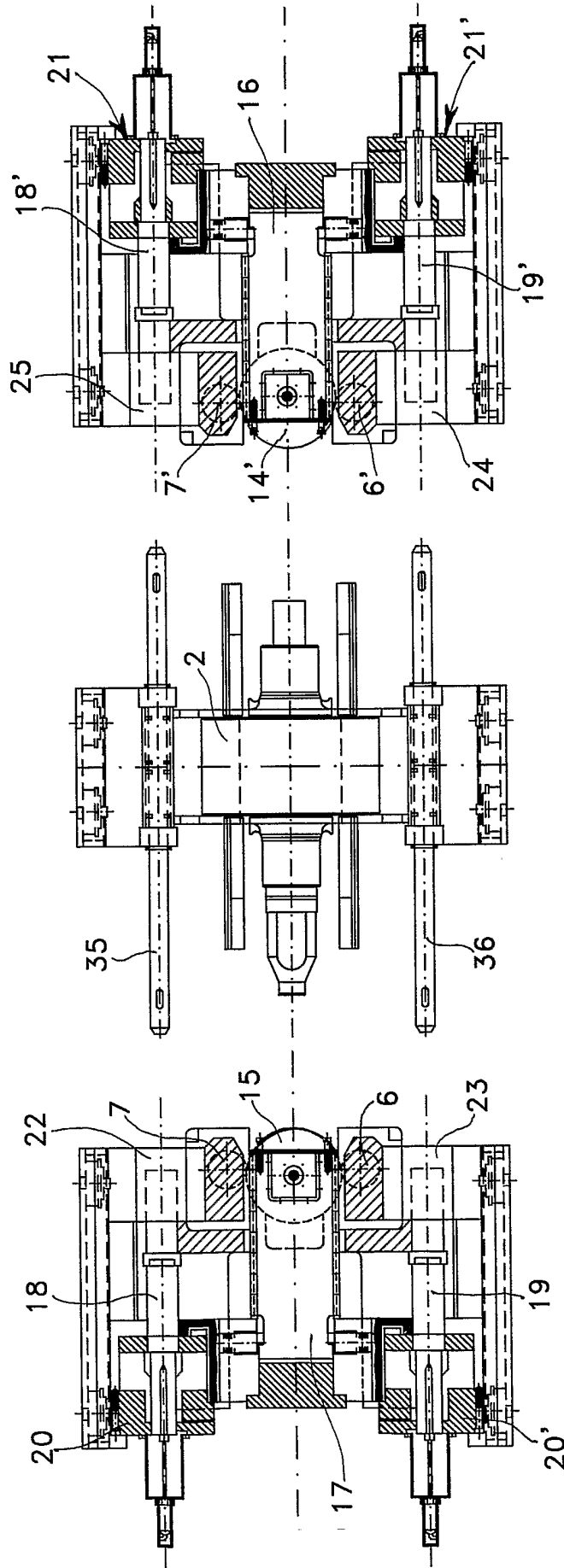


Fig. 6

Fig. 5

Fig. 4

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/09787

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 B21B31/32 B21B13/10 B21B31/04		
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) EPO-Internal, PAJ, WPI Data		
C. 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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A	column 2, line 34 -column 3, line 27 column 3, line 58 -column 4, line 5 claims 1,3,4; figures 1-3	2, 4, 12
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.		
° Special categories of cited documents :		
A document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed		*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *&* document member of the same patent family
Date of the actual completion of the international search	Date of mailing of the international search report	
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Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Rosenbaum, H	

INTERNATIONAL SEARCH REPORT

International Application No
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