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(54) ROLLING MILL BEARING POSITIONING DEVICE

(57) A rolling mill bearing chock positioning device used in steel rolling equipment comprises a first bearing chock assembly (30), an upright post (20) and a rolling mill seat (10). A stepped face (21) with a downward panel is disposed on the lower middle portion of the upright post. A retaining mechanism for retaining the upward and downward displacement of the bearing chock assembly by exerting pre-tightening pressure thereon is formed between he stepped face and the upward supporting face on the rolling mill seat. The positioning device can effectively position the lower rolling mill bearing chock by exerting pre-tightening pressure thereon.

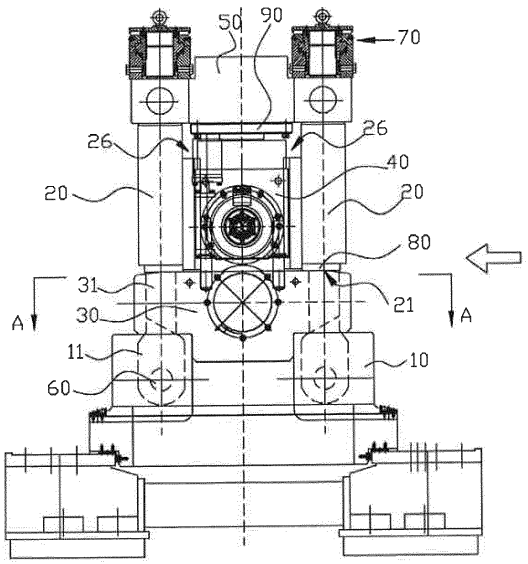

Fig. 1

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Description

Field of the Invention

[0001] The present invention relates to steel rolling equipment and, more particularly, relates to a rack structure of a rolling mill.

Description of the Prior art

[0002] The processing for wire and bar in the prior art mostly adopts rolling mill. The rolling mill can be generally categorized by its structure into sub-normal arch rack, cantilever rack or profile welding arch rack. The regulation and control for the spacing between rolls directly result in the size of the product to be rolled, and the precision of the size thereof depends on the overall rigidity of the rolling mill rack and the roller, the precision and selection of the roller. For the time being, regardless of the rack type, sub-normal arch rack or cantilever rack, taking the vertical installation of the arch rack as example, it is difficult to control as the deformation in both upward direction and downward direction is rather large. Because the lower bearing chock are fixed using components like bolts to the bottom seat of the sub-normal arch rack, and the press down mechanism of the upper bearing chock is usually provided on the upper portion of the crossbeam, so that during rolling, the upright post of the sub-normal arch rack located between the bottom seat and the upper crossbeam is subject to tension and has large elongation deformation throughout its entire length; as for the cantilever rack, the deformation of the upright post is basically similar. That is to say, if the rigidity of the rolling mill rack is not sufficient, with the deformation of other parts, the accumulated error would be large, and it is difficult to meet the precision requirements of the rolling.

[0003] The patent document named "Sheet rolling mill with hydraulic press down device on support roll" (publication number CN101658862A) has disclosed a rolling mill rack comprising a lateral frame 10 located in the upper part, a lower rack beams 12-1 located in the lower part and an upright post 1 disposed therebetween. The overall structure can be seen as the sub-normal arch rack, wherein the upright posts during work will deform with elongation within the scope of its total length.

[0004] The patent document named 'Composite rolling mill rack' (Publication number CN2796875Y) has disclosed a rack including an upper crossbeam 1 and a lower crossbeam 4 and upright posts 2 connecting the upper crossbeam 1 and the lower crossbeam 4. The upper and lower crossbeams 1, 4 and the upright posts 2 are connected to each other by rods 8 the nuts 9, so that upright post 2 is subject to compressive stress. The defect residing in the structure is that the positioning between the upper and lower crossbeams 1, 4 and the upright posts 2 in the direction perpendicular to the upright post 2 cannot meet the requirements, because the upper and lower crossbeams 1, 4 and the upright posts 2 provide pressure to each other, and maintaining the position in the direction perpendicular to the upright posts 2 relies on the frictional force between each other, which is extremely unreliable; Further, due to the retaination from the structure itself that connects the rod 8 and nut 9, the pre-tightening force is very retained. Once the external force during the rolling process offset the pre-tightening force provided by the rod and the nut 9, disengagements may occur between the upper and lower crossbeams 1, 4 and the upright posts 2 in serious cases, not to mention any precision of rolling.

[0005] The Patent Document named 'the roller gap adjustment system for the base of the rolling mill without rack' (Publication number CN1108975A) has disclosed a structure including a left-handed threaded section 22a in the upper part, a cylindrical section 22b in the middle and a screw of a right-handed threaded section 22c in the lower part. The adjacent first and second bearing chock assemblies are connected to each other by a pair of screws 12 with identical construction, and the cylindrical section 22b in the middle of the screws 12 is fixed with respect to the frame member 28 along the axial direction and made as an shaft neck so as to rotate in the frame member 28 which itself is supported on the substrate 30. a The left-handed thread section 22a in the upper part and the right-handed threaded section 22c in the lower part are connected, respectively, to the first and second bearing chock assemblies. In fact, the first and second bearing chock assemblies move to be close to or away from each other at the same time to achieve the adjustment of the roller gap. The defects residing in this scheme are described as below: the screw 12 has elongation deformation along its entire length when under the tension, and thus the rigidity is low; the lower end of the screw 12 has a drooping shape, and when the second roller 14 on the second bearing chock assembly is subject to the impact load along the proceeding direction of the wire or bar during rolling, the lower end of the screw 12 also has bending deformation under pressure, resulting in the displacement of the operative position of the first and second roller, which seriously affects the rolling precision.

[0006] There is no very satisfactory, reliable positioning scheme for lower bearing chock assembly in the prior art yet. Taking vertical working condition as example, generally speaking, usually the first to consider is the positioning and fixing of the lower bearing chock assembly, as it is relatively easy to find a positioning referential basis, but to ensure a reliable fixation of the lower bearing chock on the positioning referential basis and meanwhile not subject to the impact of an external force which would leading to a roller runout is still a technical problem not yet resolved.

Summary of the Invention

[0007] The object of the present invention is to provide a rolling mill bearing chock positioning device, which can

effectively positioning lower rolling mill bearing chock by exerting pre-tightening pressure.

[0008] To achieve the above object, the invention adopts the following technical scheme: a rolling mill bearing chock positioning device comprises a first bearing chock assembly, an upright post and a rolling mill seat, characterized in that, a stepped face with downward panel is disposed on the lower middle portion of the upright post, and the stepped face and the upward-facing supporting face on the rolling mill base form therebetween a retaining mechanism for retaining the upward and downward movement of the bearing chock assembly by exerting pre-tightening pressure thereon.

[0009] It can be known from the above technical scheme that a stepped face with a downward panel is disposed on the lower middle portion of the upright post, and the space between the stepped face and the upward-facing supporting face on the rolling mill seat receives the bearing chock assembly, Due to the reliable connection between the lower end of the upright post and the rolling mill seat, the upright post is firstly stretched to be deformed first during assembly, i.e. the length between the stepped face and junctions of the lower end thereof and the rolling mill seat is properly stretched to be deformed therewith, which means the post body below the stepped face is in a stretched state and is pressed down by the stepped face onto the bearing chock assembly, wherein the pre-tightening pressure is determined by the amount of the deformation of the stretched upright post. Thus, the runout of the bearing chock assembly is avoided and the runout only occurs when the external force to the bearing chock assembly is larger than the pre-tightening force provided by the deformation of the stretched upright post. The invention can avoid the emergence of this situation successfully, because a proper pre-tightening tension can be provided by calculating reasonable stretched deformation amount according to the magnitude of the impact force during rolling, the selected material of the upright post and the cross-section thereof.

Brief Description of the Drawings

[0010]

Figure 1 is a schematic structural diagram of the present invention;

Figure 2 is a schematic structural diagram of the upright post;

Figure 3 is a left side view of Figure 2;

Figure 4 is a cross-sectional view of FIG. 1 taken along line A-A.

Detailed Description of the Preferred Embodiments

[0011] During the wire and bar processing, the rolling precision not only depends on the roller's anti-deformation ability, i.e. rigidity, but also requires the rolling mill to have reliable rigidity, and the reliability of the fixing structure of the rack for the roller. The present invention has provided a novel and prominently effective scheme in the aspects of the rigid structure of the rack and the fixing structure of the rack for the roller. The present invention is further illustrated by the following specific embodiments.

[0012] A rolling mill bearing chock positioning device includes a first bearing chock assembly 30, an upright post 20 and a rolling mill seat 10. A downward-facing stepped face 21 is disposed on the lower middle portion of the upright post, and the stepped face 21 and the upward-facing supporting face on the rolling mill seat 10 form therebetween a position retaining mechanism for retaining upward and downward displacement of the bearing chock assembly (30) by exerting pre-tightening pressure thereon so as to position it.

[0013] The upright post 20 is stretched during assembly, to enable the length between the stepped face 21 and the junction of the lower end thereof and the rolling mill seat 10 to be properly stretched so as to be deformed, and the body of the post below the stepped face 21 is in a stretched state and is pressed down by the stepped face 21 onto the bearing chock assembly 30. The pre-tightening pressure is determined by the amount of the stretched deformation of the upright post 20. Thus, the runout of the bearing chock assembly 30 only occurs when the external impact force to the bearing chock assembly 30 is larger than the pre-tightening force provided by the stretched deformation of the upright post 20. The present invention has provided proper tightening pressure exerted on the bearing chock assembly 30 along with the support effect from the rolling mill seat 10 to enable the bearing chock assembly 30 to be reliably fixed in position.

[0014] As a preferable scheme shown in Figs. 1, 2, 3, the upper portion of the upright post 20 is a cylindrical threaded portion 22a, the middle portion of the upright post 20 is a square post portion having square cross-section, and the lower portion 22c is below the square post portion 22b. The stepped face 21 is formed at the junction between the square post portion 22b and the lower portion 22c, and the panel of the stepped face 21 is horizontal or obliquely downward. Preferably, the panel of the stepped face 21 is obliquely downward, so as to provide the maximum tightening pressure exerted on the bearing chock assembly 30 and also to facilitate the processing of the upright post 20.

[0015] As shown in Figs. 2, 3, the lower portion 22c below the stepped face 21 of the upright post 20 has rod faces 23 parallel to each other, and the rod faces 23 are perpendicular to the axial direction of a roller. The lower portion 22c is located in a groove 11 with a top opening in the rolling mill seat 10, and the spacing between the two parallel rod faces 23 match the width of the groove 11. A hinged shaft 60 is arranged between the lower end

of the lower portion 22c and the groove 11, and the hinged shaft 60 is parallel to the shaft core of the roller.

[0016] The chamber area of the groove 11 is designed to ensure that the end part of the upright post 20 can be inserted therein, and meanwhile the required space is provided for the rotation of the upright post 20. The spacing between the two parallel rod faces 23 matching the width of the groove 11 is for the purpose of retaining the displacement of the upright post 20 in the axial direction of the roller, providing the positioning basis for the positioning of the first and second bearing chock assemblies 30, 40.

[0017] A hole is provided on the end portion of the rod face 23 on the upright post 20, the hole and the hinged shaft 60 forms a hinge, and the hole is perpendicular to the plane of the rod face 23. The above structure ensures the reliability and rigidity of the cooperation between the upright post 20 and the rolling mill seat 10, that is to say, the upright post 20 can only rotate about the shaft core of the hinged shaft 60 relative to the rolling mill seat 10, which is only the cooperation relationship during dismounting and mounting of the roller, and the degrees of freedom in other directions are confined for the reason that reliable positioning can be made to the roller bearing chock assembly only when the upright post 20 is effectively positioned.

[0018] A portion of post body below the stepped face 21 of the upright post 20 is located in the slot 31 provided on the bearing chock assembly 30, and they cooperate with each other to constitute a retaining mechanism which retains the movement of the first bearing chock assembly 30 along the axial direction of the roller. As shown in Fig. 3, the stepped faces 21 are symmetrically arranged at the two sides of the rod face 23 with the centrosymmetric surface of the parallel rod faces 23, and the centrosymmetric surface of the rod face 23 is perpendicular to the axial direction of the roller, which ensures that the pressure exerted on the mouth of the slot 31 is uniform and symmetrical so as to prevent the upright post 20 from bending under the effect of bending moment.

[0019] The end face of said first bearing assembly, 30 is of an inverted convex shape, and the invented convex shape and the concave area provided on the rolling mill seat 10 constitute a retaining mechanism for retaining movement of the first bearing chock assembly 30 along the proceeding direction of the rolling material. This is the example that the positioning along the proceeding direction of the rolling material is realized by the cooperation between the first bearing chock assembly 30 and the rolling mill seat 10.

[0020] The above structure realizes the displacement of the first bearing chock assembly 30 in the upward and downward, left and right, forward and backward directions, and the rotations in corresponding directions, so as to realize the reliable positioning of the first bearing chock assembly 30.

[0021] The slot 31 is located at the front and rear sides of the chock body of the upper half of the bearing chock assembly 30 and passes through the upper and lower end faces of the upper half. The slot 31 has the opening pointing toward front and rear directions and the cross-section thereof is U-shaped. The walls of the slot 31 are parallel and the width of the slot matches the size of the post body below the stepped face 21 of the upright post 20 and located inside the slot in the axial direction of the roller so as to facilitate the engagement and disengagement of the upright post 20 and the slot 31. This is an example that the axial positioning of the first bearing chock assembly 30 is realized by the cooperation between the upright posts 20 and the first bearing chock assembly 30.

[0022] The post body between the stepped face 25 and the stepped face 21 is a cylinder which is located inside the slot 31. The two cooperate with each other to constitute a retaining mechanism which retains the movement of the first bearing chock assembly 30 along the axial direction of the roller. This cooperation relationship can realize reliable positioning and facilitate assembling as well, i.e. facilitating smooth guiding of the upright post 20 into the slot 31 or removing out of the groove 31 during rotation of the upright post 20.

[0023] The upper portion of the upright post 20 is a cylindrical threaded portion 22a, a cylindrical portion 22d is arranged between the cylindrical threaded portion 22a and the square post portion 22b, and the cylindrical portion 22d can be inserted into the hole on the upper crossbeam 50.

[0024] As shown in Fig. 1, overall, the rolling mill rack comprises an upright post 20, a rolling mill seat 10 and an upper crossbeam 50. An end of the upright post 20 is connected with the rolling mill seat 10 through a hinged shaft 60. The other end of the upright post 20 passes through the upper crossbeam 50 and is locked by a nut 70 which optionally is a hydraulic nut so as to realize reliable connection strength and reduce the manpower labor intensity during assembly. When dismounting and mounting the roller, the nut 70 can be firstly dismounted and moved away from the upper cross-beam 50, and then the upright post 20 is rotated to be disengaged and separated from one another. In that moment the space is created for the roller to be carried out or lifted out. After the roller is replaced, the upright post 20 is rotated to be in an engagement position with the roller, and then the upper crossbeam 50 is mounted and the nut 70 is screwed.

[0025] A cylindrical portion 22e is provided between the stepped face 21 of the upright post 20 and the parallel rod faces 23. A stepped face 25 facing downwardly to the rear side of the rolling mill is formed between the upper ends of the rod faces 23 and the cylindrical portion 22e, and the angle between the stepped face 25 and the horizontal plane is in the range of 50 to 80 degrees, preferably, 60 degrees. The angle ensures the roller could be mount or dismounted. The stepped face 25 is arranged for retaining the opening degree of the upright

post 20 during the rotation. As shown in Figs. 1, 2, the stepped face 25 contacts proper part of the rolling mill seat 10 when the upright post 20 is rotated to a proper position, and then the upright post 20 would be maintained at that opening position, where the upright post 20 disengages with the roller bearing chock assembly 30, so as to facilitate the dismounting and mounting procedure of the roller.

[0026] The stepped face 25 faces downwardly to the outsides in the front and rear direction along the proceeding direction of the rolling material to be rolled in the rolling mill, that is to say, the stepped face 25 differs with the different positions of the upright posts 20, i.e. two of the four upright posts 20 are located at the feeding side of the roller, and the other two upright posts 20 are located at the discharge side of the roller; the stepped faces 25 of the two upright posts 20 at the feeding side of the roller face downwardly to the front of the feeding side of the roller, the stepped faces 25 of the two upright posts 20 at the discharge side of the roller face downwardly to the rear of the feeding side of the roller. As shown in Fig. 1, the direction of the arrow is the proceeding direction of the rolling material to be rolled.

[0027] As shown in Fig. 1, a spacer block 80 is provided between the stepped face 21 and the bearing chock assembly 30 and/or between the bearing chock assembly 30 and the rolling mill seat 10. During assembly, the bearing chock assembly 30 is positioned on the rolling mill seat 10 first conveniently, and then the upright post 20 is rotated to enable the post body on the middle and lower portion thereof to be located inside the slot 31. At that moment, the stepped face 21 is higher than the upper end face of the bearing chock assembly 30 by a proper distance, so as to facilitating upright post 20 to rotate into position, The upright post 20 is stretched to deform properly and then a spacer block 80 with appropriate thickness is placed between the stepped face 21 and the upper end face of the bearing chock assembly 30 to ensure required amount of stretch of the upright post 20 to thereby ensure the pre-tightening tension.

[0028] The external force for the stretched deformation of the upright post 20 can be provided by an oil cylinder, which is briefly described as follows.

[0029] The oil cylinder 90 is provided between the second bearing chock assembly 40 and the upper cross-beam 50 to move downward to press down the second bearing chock assembly 40, which moves downward and contacts the first bearing chock assembly 30 and transmits the pressure to the rolling mill seat 10. Then, there is a tendency for the upper cross-beam 50 and the rolling mill seat 10 to be away from each other, which is restricted by the upright post 20, so that the upright post 20 is subject to tension and stretched and deforms. The amount of the stretched deformation is corresponding to working pressure of the oil cylinder 90, so that proper pre-tightening stretched deformation of the upright post 20 can be achieved so as to provide proper pre-tightening pressure to be exerted on the first bearing chock assembly 30.

[0030] The present invention adopts the scheme with the lower portion of the upright post 20 exerting pre-tightening pressure on the first bearing chock assembly 30. Under the effect of the external force from normal rolling process, the lower portion of the upright post 20 would no longer elongate, that is to say, the first bearing chock assembly 30 is reliably positioned. Even though the post body of the upright post 20 above the stepped face 21 is stretched, the influence in the change of the spacing between the rollers is very retained, so that the rolling precision is largely improved. This providers a reliable foundation of assembly for the online adjustment and control to the spacing between the rollers of the rolling mill.

Claims

1. A rolling mill bearing chock positioning device, comprising a first bearing chock assembly (30), an upright post (20) and a rolling mill seat (10), **characterized in that**, a downward-facing stepped face (21) is disposed on the lower middle portion of the upright post (20), and the stepped face (21) and the upward-facing supporting face of the rolling mill seat (10) form therebetween a retaining mechanism for retaining the upward and downward displacement of the bearing chock assembly (30) by exerting pre-tightening pressure thereon.

2. The rolling mill bearing chock positioning device according to claim 1, **characterized in that**, the upper portion of the upright post (20) is a cylindrical threaded portion (22a), the middle portion of the upright post (20) is a square post portion (22b) having square cross-section, the lower portion (22c) is below the square post portion (22b), a stepped face (21) is formed at the junction between the square post portion (22b) and the lower portion (22c), and the panel of the stepped face (21) is horizontal or obliquely downward.

3. The rolling mill bearing chock positioning device according to claim 1, **characterized in that**, the lower portion (22c) below the stepped face (21) of the upright post (20) has rod faces (23) parallel to each other, the rod faces (23) are perpendicular to the axial direction of a roller, the lower portion (22c) is located in a groove (11) with a top opening in the rolling mill seat (10), the spacing between the two parallel rod faces (23) matches the width of the groove (11), a hinged shaft is arranged between the lower end of the lower portion (22c) and the groove (11), and the hinged shaft is parallel to the shaft core of the roller.

4. The rolling mill bearing chock positioning device according to claim 1, **characterized in that**, a portion of post body below the stepped face (21) of the up-

right post (20) is located in a slot (31) provided on the bearing chock assembly (30), the two cooperate with each other to constitute a retaining mechanism which retains the movement of the first bearing chock assembly (30) along the axial direction of the roller.

5. The rolling mill bearing chock positioning device according to claim 1, **characterized in that**, the end face of said first bearing assembly (30) is of an inverted convex shape, and with the concave area provided on the rolling mill seat (10), constituting a retaining mechanism for retaining movement of the first bearing chock assembly (30) along the proceeding direction of the rolling material.

6. The rolling mill bearing chock positioning device according to claim 1, **characterized in that**, the upper portion of the upright post (20) is a cylindrical threaded portion (22a), a cylindrical portion (22d) is arranged between the cylindrical threaded portion (22a) and the square post portion (22b), the cylindrical portion (22d) can be inserted into the hole on an upper crossbeam (50), the upper end of the post face on the square post portion (22b) on the discharge side of the material is provided with an oblique face (24) which transits from the square post portion (22b) to the cylindrical portion (22d), and the lower end face of the upper crossbeam (50) is provided with an oblique face (51) matching the oblique face (24).

7. The rolling mill bearing chock positioning device according to claim 1, **characterized in that**, a cylindrical portion (22e) is provided between the stepped face (21) of the upright post (20) and the parallel rod faces (23), a stepped face (25) facing downwardly to the rear side of the rolling mill is formed between the upper end of the rod face (23) and the cylindrical portion (22e), the angle between the stepped face (25) and the horizontal plane is in the range of 50 to 80 degrees, preferably, 60 degrees.

8. The rolling mill bearing chock positioning device according to claim 1, **characterized in that**, a spacer block (80) is provided between the stepped face (21) and the bearing chock assembly (30) and/or between the bearing chock assembly (30) and the rolling mill seat (10).

9. The rolling mill bearing chock positioning device according to claim 4 or 5, **characterized in that**, the slot (31) is located at the front and rear side of the chock body of the upper half of the bearing chock assembly (30) and passes through the upper and lower end faces of the upper half, the opening of the slot (31) points toward front and rear directions and the cross-section thereof is U-shaped, the walls of the slot (31) are parallel and the width of the slot matches the size of the post body below the stepped face (21) of the upright post (20) and located inside the slot in the axial direction of the roller.

10. The rolling mill bearing chock positioning device according to claim 7 or 9, **characterized in that**, the main body between the stepped face (25) and the stepped face (21) is a cylinder which is located inside the slot (31).

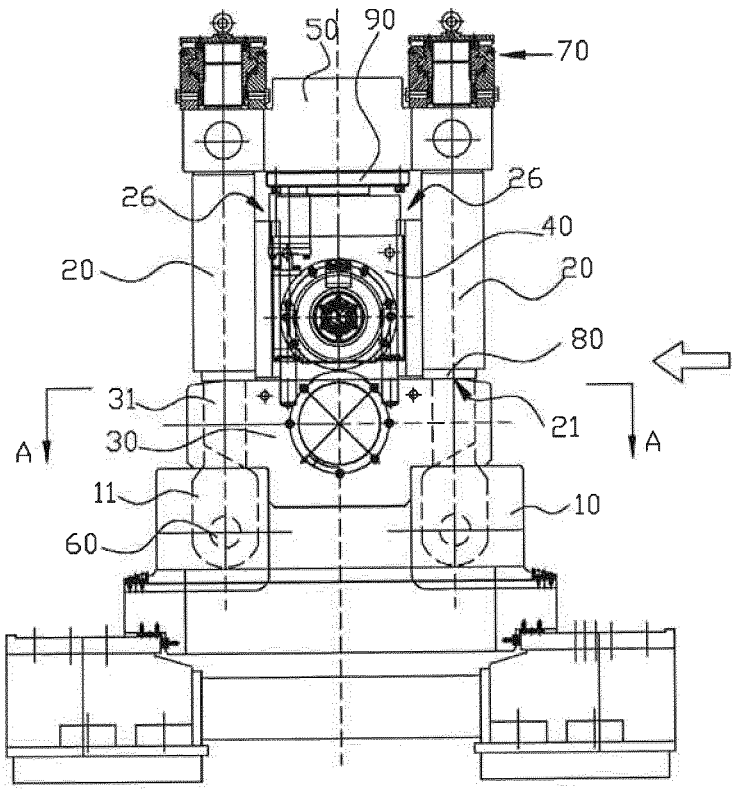

Fig. 1

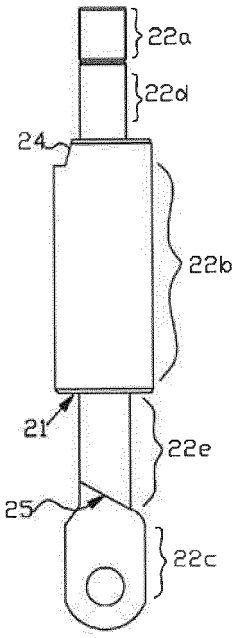

Fig. 2

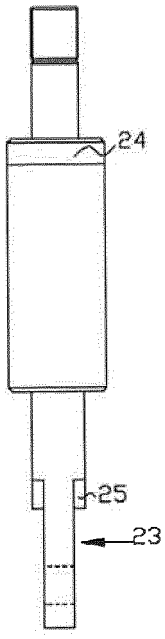

Fig. 3

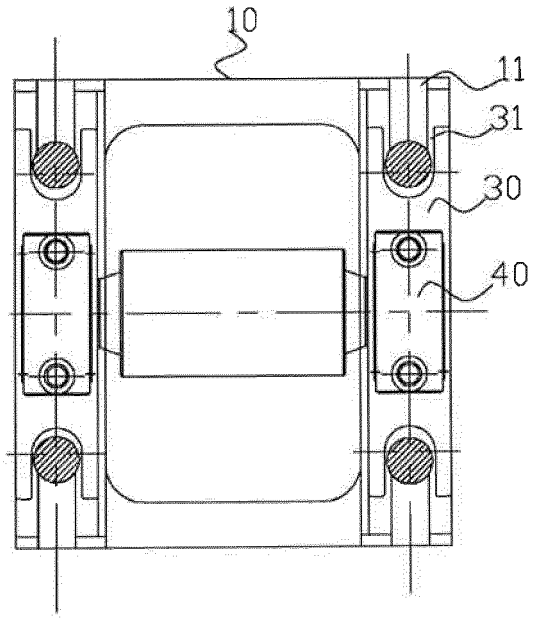

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2012/075648

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet

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: 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 practicable, search terms used)

WPI; EPODOC; CNPAT; CNKI: rolling mill, locating, bearing seat, rolling stand, roll, mill, fix, immovably, seat, bar, rod, upright, step, sidestep

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0166478 A1 (POMINI FARREL SPA), 02 January 1986 (02.01.1986), see page 2, line 29 to page 4, line 2, and figures 1-3	1-10
A	US 3938362 A (FALK et al.), 17 February 1976 (17.02.1976), see the whole document	1-10
A	EP 0040584 A1 (DANIELI & C OFF MEC SPA), 25 November 1981 (25.11.1981), see the whole document	1-10
A	CN 101428299 A (BEIJING UNIVERSITY OF TECHNOLOGY), 13 May 2009 (13.05.2009), see the whole document	1-10
A	CN 201144089 Y (WISDRI ENGINEERING & RESEARCH CO., LTD.), 05 November 2008 (05.11.2008), see the whole document	1-10

☒ Further documents are listed in the continuation of Box C. ☒ See patent family 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 application or patent but published on or after the international filing date

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 August 2012 (10.08.2012)	**30 August 2012 (30.08.2012)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **XU, Han** Telephone No.: (86-10) **62085424**

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2012/075648

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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Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2012/075648

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Form PCT/ISA/210 (patent family annex) (July 2009)

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CONTINUATION OF SECOND SHEET: A. CLASSIFICATION OF SUBJECT MATTER

B21B 31/16 (2006.01) i

B21B 31/32 (2006.01) i

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REFERENCES CITED IN THE DESCRIPTION

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