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(71) Applicant: **University Of Science And Technology Beijing**
Beijing 100083 (CN)

(72) Inventors:
- **WANG, Baoyu**
  Haidian District, Beijing 100083 (CN)
- **LIN, Longfei**
  Haidian District, Beijing 100083 (CN)
- **LIU, Jinping**
  Haidian District, Beijing 100083 (CN)
- **LIU, Shengqiang**
  Haidian District, Beijing 100083 (CN)
- **ZHANG, Huibo**
  Haidian District, Beijing 100083 (CN)

(74) Representative: **Gille Hrabal**
Brucknerstrasse 20
40593 Düsseldorf (DE)

(54) SKEW ROLLING MILL WITH DUAL-ROTATABLE-SHAFTS

(57) The present invention relates to the technical field of metal plastic forming processes and equipment and provides a skew rolling mill with dual-rotatable-shafts, which comprises a base unit, a guide plate unit, a left bed rotatable shaft, a right bed rotatable shaft, a left bed, a right bed, a left synchronizing gear, a right synchronizing gear, a left roll system, a right roll system, a left roller, a right roller, tilt angle adjusting bolts and a roller distance adjusting unit. The guide plate unit is fixed on a base; the two bed rotatable shafts are symmetrically arranged about the axis of a billet; the left synchronizing gear and the right synchronizing gear are engaged, such that the two beds are synchronously centered and pressed down; the two rollers are coaxially fixed by the two roll systems respectively; the tilt angle adjusting bolts are used for adjusting the tilt angles of the two rollers; the roller distance adjusting unit is used for adjusting the opening of the two beds to change and adjust the roller spacing between the two rollers; and under the action of the friction force of the rollers/the billet, the billet is subjected to skew rolling forming between the two rollers. The skew rolling mill has the advantages that the beds are synchronously centered and pressed down, the vertical center line does not offset, the strength of the beds is high, the mounting and debugging are simple and the like such that the skew rolling mill can be applied to mass skew rolling forming of middle and small size parts.

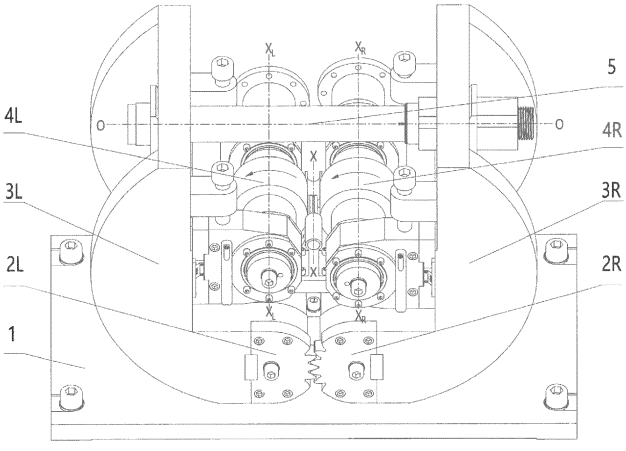

Fig. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to the technical field of metal plastic forming processes and equipment, and in particular relates to a skew rolling mill with dual-rotatable-shafts.

BACKGROUND

[0002] Since skew rolling processes have such advantages as high production efficiency, high forming precision and high material utilization rate, a skew rolling mill has been widely applied in the field of metal plastic forming, mainly including plastic forming of parts like steel grinding balls, bearing steel balls, bearing steel ball rollers, anodic phosphor copper balls, anchor rods, amour-piercing steel cores, anti-skid nails, threaded rods, lead screws and spline shafts. Due to the advantages of no damage to surface fiber of a formed piece, improvement to surface performance, high material utilization rate, and high production efficiency, the skew rolling mill has now been widely adopted by the market.

[0003] At present, there are mainly three types of skew rolling mills: a frame type, a machine tool type and a clamp type. A frame type skew rolling mill that adopts a frame type structure and has the advantages of large mechanical stiffness, reliability in use and the like is a main device for large-tonnage skew rolling forming of steel grinding balls, bearing steel balls, bearing steel ball rollers, anodic phosphor copper balls, anchor rods, amour-piercing steel cores, anti-skid nails and the like currently. However, the defects of being large in tonnage, having many parts involved, being complicated in mounting and debugging, being not compact in device structure and the like also exist. A machine tool type skew rolling mill that adopts a machine tool type structure, is equipped with an automatic system and has the advantages of being compact in device structure, being simple in mounting and debugging and the like, is the main device for forming processes including roll threading, spline rolling, linear knurling, knurling, lead screw rolling, rolling-cutting and the like in the market currently. However, due to small power, the skew rolling mill is generally used for warm and cold forming of small- and medium-sized parts. A clamp type skew rolling mill that adopts a structure in which a left clamp and a right clamp rotate around a middle rotatable shaft and has the advantages of being simple in debugging, having few parts involved, being easy in manufacturing, small in device weight and the like, is slightly applied to such aspects as forming, roll threading, spline rolling and the like of small-sized ball parts. However, the defects of being not high in stiffness, large in work noise, complicated in adjustment of a guide plate and the like exist.

[0004] Therefore, it seems significantly vital to overcome defects of an existing device and invent a novel skew rolling device being high in stiffness, compact in structure and simple in adjustment.

SUMMARY

[0005] The objective of the present invention is to overcome defects of the prior art and provide a skew rolling mill with dual-rotatable-shafts, which adopts a dual-rotating-shaft structure, and realizes the effect that two beds are synchronously centered and pressed down by means of synchronizing gears.

[0006] The present invention adopts the following technical solution:

a skew rolling mill with dual-rotatable-shafts, comprising: a base unit, a guide plate unit, a bed unit, a rolling unit, a bed synchronizing unit, a roller distance adjusting unit and tilt angle adjusting units;

the bed unit comprises a left bed and a right bed which are fixedly mounted on a base respectively by virtue of a left bed rotatable shaft and a right bed rotatable shaft, and the left bed rotatable shaft and the right bed rotatable shaft are symmetrically arranged about the axis of a billet; the left bed and the right bed are capable of rotating around the left bed rotatable shaft and the right bed rotatable shaft respectively;

the rolling unit comprises two rollers that are used for rolling the billet, and the two rollers are fixedly mounted on the left bed and the right bed respectively by virtue of roll systems;

the bed synchronizing unit is used for enabling the left bed and the right bed to synchronously rotate in opposite directions;

the roller distance adjusting unit is used for adjusting the opening distance between the upper part of the left bed and the upper part of the right bed, thus adjusting the roller spacing between the two rollers;

the tilt angle adjusting units are used for adjusting tilt angles α of the axes of the rollers relative to the axis of the billet; and

the guide plate unit is used for preventing swing of the billet and limiting the rotation of the billet between the two rollers.

[0007] Further, the rolling unit comprises a left roll system, a right roll system, a left roller and a right roller;

the left roll system and the right roll system each include a main shaft, a feeding end bearing seat, a discharging end bearing seat, a coupler and a thread bushing;

the couplers are connected to the main shafts for inputting power for the main shafts; the rollers are mounted on the main shafts; the main shafts are jointly supported by the feeding end bearing seats and the discharging end bearing seats; the feeding end bearing seats are fixedly mounted on the discharging end bearing seats; and the discharging end bearing seats are supported by the beds and are fixed by the thread bushings and locking

bolts which are matched with each other.

[0008] Further, circular arc segments are processed on lower end surfaces of side back plates of the discharging end bearing seats, and the axes of the circular arc segments coincide with the horizontal rolling center line; the discharging end bearing seats are capable of rotating around the horizontal rolling center line so as to adjust the size of the tilt angles α;

the middles of the side back plates of the discharging end bearing seats are fixedly provided with the thread bushings, and the axes of the thread bushings coincide with the horizontal rolling center line; the thread bushings are matched with locking bolts, and the left roll system and the right roll system are respectively fixed on the left bed and the right bed by the locking bolts; and

the horizontal rolling center line is a connecting line of geometric centers of the left roller and the right roller.

[0009] Further, the bed synchronizing unit comprises a left synchronizing gear and a right synchronizing gear, which are respectively fixed on the left bed and the right bed; the left synchronizing gear and the right synchronizing gear are respectively coaxial with the left bed rotatable shaft and the right bed rotatable shaft; the left synchronizing gear and the right synchronizing gear are engaged, thus enabling the rotation motion of the left bed and the right bed around the left bed rotatable shaft and the right bed rotatable shaft respectively to be changed into the opposite-direction motion at the same speed.

[0010] Further, the roller distance adjusting unit comprises a pull rod, an adjusting nut, a locking nut, a cylindrical block, a cylindrical gasket and a spherical gasket; the cylindrical gasket and the spherical gasket are fixed on upper ends of the beds, and the cylindrical block is fixed to the pull rod;

the cylindrical block is capable of rotating around the cylindrical gasket, and the adjusting nut is capable of rotating around the spherical gasket;

the opening distance between the upper part of the left bed and the upper part of the right bed can be adjusted by rotating the adjusting nut, thereby changing the roller spacing between the left roller and the right roller.

[0011] Further, graduations are processed on the pull rod and the adjusting nut, or the pull rod and the adjusting nut are provided with graduated rulers.

[0012] Further, the tilt angle adjusting units are a plurality of screw-down nuts;

the left bed and the right bed are each provided with two screw-down nuts, and the screw-down nuts are respectively disposed at the upper parts of the feeding end bearing seats and the discharging end bearing seats; and when the screw-down nuts are rotated, the discharging end bearing seats can be made to rotate around the horizontal rolling center line, thus adjusting the size of the tilt angles α.

[0013] Further, the base unit comprises a base, a bed rotatable shaft seat and a bed rotatable shaft cover; the bed rotatable shaft seat is fixed on the base, and the bed rotatable shaft cover is arranged on the rotatable shaft seat; and the bed rotatable shaft seat and the bed rotatable shaft cover are upper and lower split seats of the bed rotatable shafts, and bed rotatable shaft mounting holes are processed in the bed rotatable shaft seat and the bed rotatable shaft cover with the axis of the billet as a symmetry center.

[0014] Further, the guide plate unit comprises a guide plate seat, a feeding guide cylinder, a middle guide plate and a discharging guide slot;

the guide plate seat is fixed on the base; the feeding guide cylinder, the middle guide plate and the discharging guide slot are all fixed to the upper part of the guide plate seat; and the feeding guide cylinder and the middle guide plate are capable of preventing swing of the billet and limiting the rotation of the billet between two rollers, and the discharging guide slot is used for guiding a formed piece out.

[0015] Further, the skew rolling mill with dual-rotatable-shafts is used for cold rolling or hot rolling, wherein the cold rolling temperature is room temperature, and the hot rolling temperature is 600 DEG to 1400 DEG

[0016] The present invention has the beneficial effects as follows:

1. The left and right beds are supported by the dual rotatable shafts, so that the overall structure is stabler.
2. During the process of adjusting the roller spacing, the dual-rotating-shaft structure makes the vertical offset of the horizontal rolling center line smaller.
3. With the adoption of a gear synchronizing mechanism, the two beds are centered and pressed down synchronously, so that the vertical center line of the skew rolling mill does not offset.
4. With the adoption of an "L"-shaped semi-circular-arc bed structure, the stress line is short, and the strength of the beds is high.
5. The back plates of the bearing seats adopt large circular arc segments for positioning and mounting with the beds, resulting in reduced vibration of the two roll systems.
6. The adjusting nut and the tilt angle adjusting bolts are arranged and graduations are provided for adjusting the roller spacing and the tilt angles, resulting in simple mounting and debugging.
7. The skew rolling mill has the advantages that the beds are synchronously centered and pressed down, the vertical center line does not offset, the strength of the beds is high, the mounting and debugging are simple and the like such that the skew rolling mill can be applied to mass skew rolling forming of middle and small size parts.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is an overall structure schematic diagram of a

skew rolling mill with dual-rotatable-shafts in an embodiment of the present invention.

Fig. 2 is a position and structure schematic diagram of a base part, a left rotatable shaft, a right rotatable shaft and a guide plate part in an embodiment.

Fig. 3 is a position and structure schematic diagram of a base, a rotatable shaft base, a left rotatable shaft, a right rotatable shaft, a left bed, a right bed, a left synchronizing gear and a right synchronizing gear in an embodiment.

Fig. 4 is a position and structure schematic diagram of a left bed set, a feeding end bearing seat, a discharging end bearing seat and tilt angle adjusting bolts in an embodiment.

Fig. 5 is a position and structure schematic diagram of a left roll system and a left roller in an embodiment.

Fig. 6 is a structure schematic diagram of a roller distance adjusting unit in an embodiment.

[0018] In the drawings, 1- base, 2L- left synchronizing gear, 2R- right synchronizing gear, 3L- left bed, 3R- right bed, 4L- left roller, 4R- right roller, 5- pull rod, 6L- left rotatable shaft, 6R- right rotatable shaft, 7- feeding guide cylinder, 8- middle guide plate, 9- discharging guide slot, 10- guide plate seat, 11- rotatable shaft cover, 12-rotatable shaft seat, 13- tilt angle graduated ruler, 14- feeding end bearing seat, 15- tilt angle adjusting bolt, 16- thread bushing, 17- discharging end bearing seat, 18- main shaft, 19- coupler, 20- cylindrical block, 21- cylindrical gasket, 22- locking nut, 23-spherical gasket, and 24- adjusting nut.

[0019] X-X- axis of billet; X_L-X_L- axis of left roll system and axis of left roller; X_R-X_R- axis of right roll system and axis of right roller; X_L'-X_L'- axis of left bed rotatable shaft and axis of left synchronizing gear, X_R'-X_R'- axis of right bed rotatable shaft and axis of right synchronizing gear, Y-Y- horizontal rolling center line, and O-O- axis of pull rod.

DETAILED DESCRIPTION

[0020] Specific embodiments of the present invention will be described in details below in conjunction with accompanying figures. It should be noted that the technical features or combinations thereof described in the following embodiments should not be deemed as isolated and they may be mutually combined so as to achieve a better technical effect.

[0021] As shown in Fig. 1, an embodiment of the present invention provides a skew rolling mill with dual-rotatable-shafts, comprising a base unit, a guide plate unit, a left rotatable shaft 6L, a right rotatable shaft 6R, a left bed 3L, a right bed 3R, a left synchronizing gear 2L, a right synchronizing gear 2R, a left roll system, a right roll system, a left roller 4L, a right roller 4R, tilt angle adjusting bolts 15 and a roller distance adjusting unit.

[0022] As shown in Figs. 1 and 2, the base unit is fixed on a mounting foundation and is used for fixing a skew rolling mill body. Preferably, the base unit comprises a base 1, a bed rotatable shaft seat 12 and a bed rotatable shaft cover 11. The bed rotatable shaft seat 12 is fixedly mounted on the base 1 by virtue of threads or welding, and the bed rotatable shaft cover 11 is fastened to and mounted on the rotatable shaft seat 12 by bolts.

[0023] As shown in Figs. 1 and 2, the guide plate unit is fixedly mounted on the base part and comprises a guide plate seat 10, a feeding guide cylinder 7, a middle guide plate 8, and a discharging guide slot 9. The feeding guide cylinder 7, the middle guide plate 8 and the discharging guide slot 9 are fixed to the guide plate seat 10 by means of threads. The feeding guide cylinder 7 and the middle guide plate 8 can prevent swing of a billet and limit the rotation of the billet between the two rollers, and the discharging guide slot 9 is used for guiding a formed piece out.

[0024] As shown in Figs. 1 and 2, the left bed rotatable shaft 6L and the right bed rotatable shaft 6R are the same in geometric dimensions, are symmetrically arranged about the axis X-X of the billet and are mounted under the support of the rotatable shaft seat 12 and the rotatable shaft cover 11.

[0025] As shown in Figs. 1 and 3, the left bed 3L and the right bed 3R are the same in geometric dimensions, are symmetrically arranged about the axis X-X of the billet and are respectively mounted under the support of the left bed rotatable shaft 6L and the right bed rotatable shaft 6R, such that the left bed 3L and the right bed 3R can do rotation motion around the left bed rotatable shaft 6L and the right bed rotatable shaft 6R respectively.

[0026] As shown in Figs. 1 and 3, the left synchronizing gear 2L and the right synchronizing gear 2R are the same in geometric dimensions and are respectively fixed onto the left bed 3L and the right bed 3R, the axis X_L'-X_L' coincides with the axis X_L'-X_L' of the left bed rotatable shaft 6L, and the axis X_R'-X_R' coincides with the axis X_R'-X_R' of the right rotatable shaft 6R. The left synchronizing gear 2L and the right synchronizing gear 2R are engaged, thus enabling the rotation motion of the left bed 3L and the right bed 3R around the left bed rotatable shaft 6L and the right bed rotatable shaft 6R respectively to be changed into the opposite-direction motion at the same speed, so that the left bed 3L and the right bed 3R can be synchronously centered and pressed down, and accordingly it is guaranteed that the vertical center line of the skew rolling mill does not offset.

[0027] As shown in Figs. 1, 4 and 5, the left roll system and the right roll system which are the same in forming components and geometric dimensions and can rotate around the horizontal rolling center line Y-Y of the skew

rolling mill, are arranged at two sides of the axis X-X of the billet, are staggered with the axis X-X of the billet at an tilt angle α and are respectively mounted under the support of the left bed 3L and the right bed 3R. The left roll system and the right roll system each comprise a main shaft 18, a feeding end bearing seat 14, a discharging end bearing seat 17, a coupler 19 and a thread bushing 16. Circular arc segments (matched with circular arc parts disposed on the beds) are processed on the lower end surfaces of side back plates of the discharging end bearing seats 17, and the axes of the circular arc segments coincide with the vertical rolling center line Y-Y of the skew rolling mill. The middles of the side back plates of the discharging end bearing seats 17 are fixedly provided with the thread bushings 16, and the axes of the thread bushings 16 coincide with the horizontal rolling center line Y-Y of the skew rolling mill. The discharging end bearing seats 17 can be adjusted by the screw-down nuts to rotate around the horizontal rolling center line Y-Y so as to adjust the size of the tilt angles α. The thread bushings 16 are matched with locking nuts for respectively fixing the left roll system and the right roll system onto the left bed 3L and the right bed 3R. Preferably, the left bed 3L, the right bed 3R and the discharging end bearing seats 17 are all provided with tilt angle graduated rulers 13 for displaying the size of the tilt angles α.

[0028] As shown in Figs. 1 and 5, the left roller 4L and the right roller 4R are the same in geometric dimensions, the axis X_L-X_L of the left roller coincides with the axis X_L-X_L of the left roll system, and the axis X_R-X_R of the right roller coincides with the axis X_R-X_R of the right roll system.

[0029] As shown in Figs. 1 and 4, the tilt angle adjusting bolts 15 are arranged at the upper parts of the discharging end bearing seats 17. By rotating the tilt angle adjusting bolts 15, the discharging end bearing seats 17 are made to rotate around the horizontal rolling center line Y-Y, thus adjusting the tilt angle α.

[0030] As shown in Figs. 1 and 6, the roller distance adjusting unit is arranged at the upper ends of the left bed 3L and the right bed 3R, and comprises a pull rod 5, an adjusting nut 24, a locking nut 22, a cylindrical block 20, a cylindrical gasket 21 and a spherical gasket 23. The cylindrical gasket 21 and the spherical gasket 23 are fixed to the beds, and the cylindrical block 20 is fixed to the pull rod 5. The cylindrical block 20 can rotate around the cylindrical gasket 21, and the adjusting nut 24 can rotate around the spherical gasket 23. Preferably, graduations are processed on the pull rod 5 and the adjusting nut 23, or the pull rod 5 and the adjusting nut 23 are provided with graduated rulers.

[0031] The adjusting nut 24 can adjust the opening distance between the upper part of the left bed 3L and the upper part of the right bed 3R, thus adjusting the roller spacing between the left roller 4L and the right roller 4R.

[0032] The working principle of the present invention is: the billet heated to the rolling temperature (room temperature for cold rolling and the temperature of 600 DEG to 1400 DEG for hot rolling) is transferred into the skew rolling mill, power is inputted by the couplers 19, the inputted power is respectively transferred to the left roller 4L and the right roller 4R by the main shafts 18, so as to drive the left roller 4L and the right roller 4R to do same-direction synchronous rotation motion. Under the action of the friction force of the rollers/the billet, the billet is subjected to skew rolling forming between the left roller 4L and the right roller 4R.

[0033] The skew rolling mill has the advantages that the beds are synchronously centered and pressed down, the vertical center line does not offset, the strength of the beds is high, the mounting and debugging are simple and the like such that the skew rolling mill can be applied to mass skew rolling forming of middle- and small-sized parts.

[0034] Although a plurality of embodiments of the present invention have been provided in the text, those skilled in the art should understand that embodiments in the text can be modified without departing from the spirit of the present invention. The above embodiments are merely exemplary, such that the range of right in the present application should not be defined based on embodiments of the text.

Claims

1. A skew rolling mill with dual-rotatable-shafts, wherein comprising a base unit, a guide plate unit, a bed unit, a rolling unit, a bed synchronizing unit, a roller distance adjusting unit and tilt angle adjusting units;
the bed unit comprises a left bed and a right bed which are fixedly mounted on a base respectively by virtue of a left bed rotatable shaft and a right bed rotatable shaft, and the left bed rotatable shaft and the right bed rotatable shaft are symmetrically arranged about the axis of a billet; the left bed and the right bed are capable of rotating around the left bed rotatable shaft and the right bed rotatable shaft respectively;
the rolling unit comprises two rollers that are used for rolling the billet, and the two rollers are fixedly mounted on the left bed and the right bed respectively by virtue of roll systems;
the bed synchronizing unit is used for enabling the left bed and the right bed to synchronously rotate in opposite directions;
the roller distance adjusting unit is used for adjusting the opening distance between the upper part of the left bed and the upper part of the right bed, thus adjusting the roller spacing between the two rollers;
the tilt angle adjusting units are used for adjusting tilt angles α of the axes of the rollers relative to the axis of the billet; and
the guide plate unit is used for preventing swing of the billet and limiting the rotation of the billet between the two rollers.

2. The skew rolling mill with dual-rotatable-shafts according to claim 1, wherein the rolling unit comprises a left roll system, a right roll system, a left roller and a right roller;
the left roll system and the right roll system each include a main shaft, a feeding end bearing seat, a discharging end bearing seat, a coupler and a thread bushing;
the couplers are connected to the main shafts for inputting power for the main shafts; the rollers are mounted on the main shafts; the main shafts are jointly supported by the feeding end bearing seats and the discharging end bearing seats; the feeding end bearing seats are fixedly mounted on the discharging end bearing seats; and the discharging end bearing seats are supported by the beds and are fixed by the thread bushings and locking bolts which are matched.

3. The skew rolling mill with dual-rotatable-shafts according to claim 2, wherein circular arc segments are processed on lower end surfaces of side back plates of the discharging end bearing seats, and the axes of the circular arc segments coincide with the horizontal rolling center line; the discharging end bearing seats are capable of rotating around the horizontal rolling center line so as to adjust the size of the tilt angles α;
the middles of the side back plates of the discharging end bearing seats are fixedly provided with the thread bushings, and the axes of the thread bushings coincide with the horizontal rolling center line; the thread bushings are matched with the locking bolts, and the left roll system and the right roll system are respectively fixed on the left bed and the right bed by the locking bolts; and
the horizontal rolling center line is a connecting line of geometric centers of the left roller and the right roller.

4. The skew rolling mill with dual-rotatable-shafts according to any one of claims 1-3, wherein the bed synchronizing unit comprises a left synchronizing gear and a right synchronizing gear, which are respectively fixed on the left bed and the right bed; the left synchronizing gear and the right synchronizing gear are respectively coaxial with the left bed rotatable shaft and the right bed rotatable shaft; the left synchronizing gear and the right synchronizing gear are engaged, thus enabling the rotation motion of the left bed and the right bed around the left bed rotatable shaft and the right bed rotatable shaft respectively to be changed into opposite-direction motion at the same speed.

5. The skew rolling mill with dual-rotatable-shafts according to claim 3, wherein the roller distance adjusting unit comprises a pull rod, an adjusting nut, a locking nut, a cylindrical block, a cylindrical gasket and a spherical gasket;
the cylindrical gasket and the spherical gasket are fixed on upper ends of the beds, and the cylindrical block is fixed to the pull rod;
the cylindrical block is capable of rotating around the cylindrical gasket, and the adjusting nut is capable of rotating around the spherical gasket;
the opening distance between the upper part of the left bed and the upper part of the right bed can be adjusted by rotating the adjusting nut, thereby changing the roller spacing between the left roller and the right roller.

6. The skew rolling mill with dual-rotatable-shafts according to claim 5, wherein graduations are processed on the pull rod and the adjusting nut, or the pull rod and the adjusting nut are provided with graduated rulers.

7. The skew rolling mill with dual-rotatable-shafts according to claim 3, wherein the tilt angle adjusting units are a plurality of screw-down nuts;
the left bed and the right bed are each provided with two screw-down nuts, and the screw-down nuts are respectively disposed at the upper parts of the feeding end bearing seats and the discharging end bearing seats; and when the screw-down nuts are rotated, the discharging end bearing seats are made to rotate around the horizontal rolling center line, thus adjusting the size of the tilt angles α.

8. The skew rolling mill with dual-rotatable-shafts according to any one of claims 1-7, wherein the base unit comprises a base, a bed rotatable shaft seat and a bed rotatable shaft cover; the bed rotatable shaft seat is fixed on the base, and the bed rotatable shaft cover is arranged on the rotatable shaft seat; and the bed rotatable shaft seat and the bed rotatable shaft cover are upper and lower split seats of the bed rotatable shafts, and bed rotatable shaft mounting holes are processed in the bed rotatable shaft seat and the bed rotatable shaft cover with the axis of the billet as a symmetry center.

9. The skew rolling mill with dual-rotatable-shafts according to any one of claims 1-7, wherein the guide plate unit comprises a guide plate seat, a feeding guide cylinder, a middle guide plate and a discharging guide slot;
the guide plate seat is fixed on the base; the feeding guide cylinder, the middle guide plate and the discharging guide slot are all fixed to the upper part of the guide plate seat; the feeding guide cylinder and the middle guide plate are capable of preventing swing of the billet and limiting the rotation of the billet between two rollers, and the discharging guide slot is used for guiding a formed piece out.

10. The skew rolling mill with dual-rotatable-shafts according to claim 1, wherein the skew rolling mill with dual-rotatable-shafts is used for cold rolling or hot rolling, wherein the cold rolling temperature is room temperature, and the hot rolling temperature is 600 DEG to 1400 DEG.

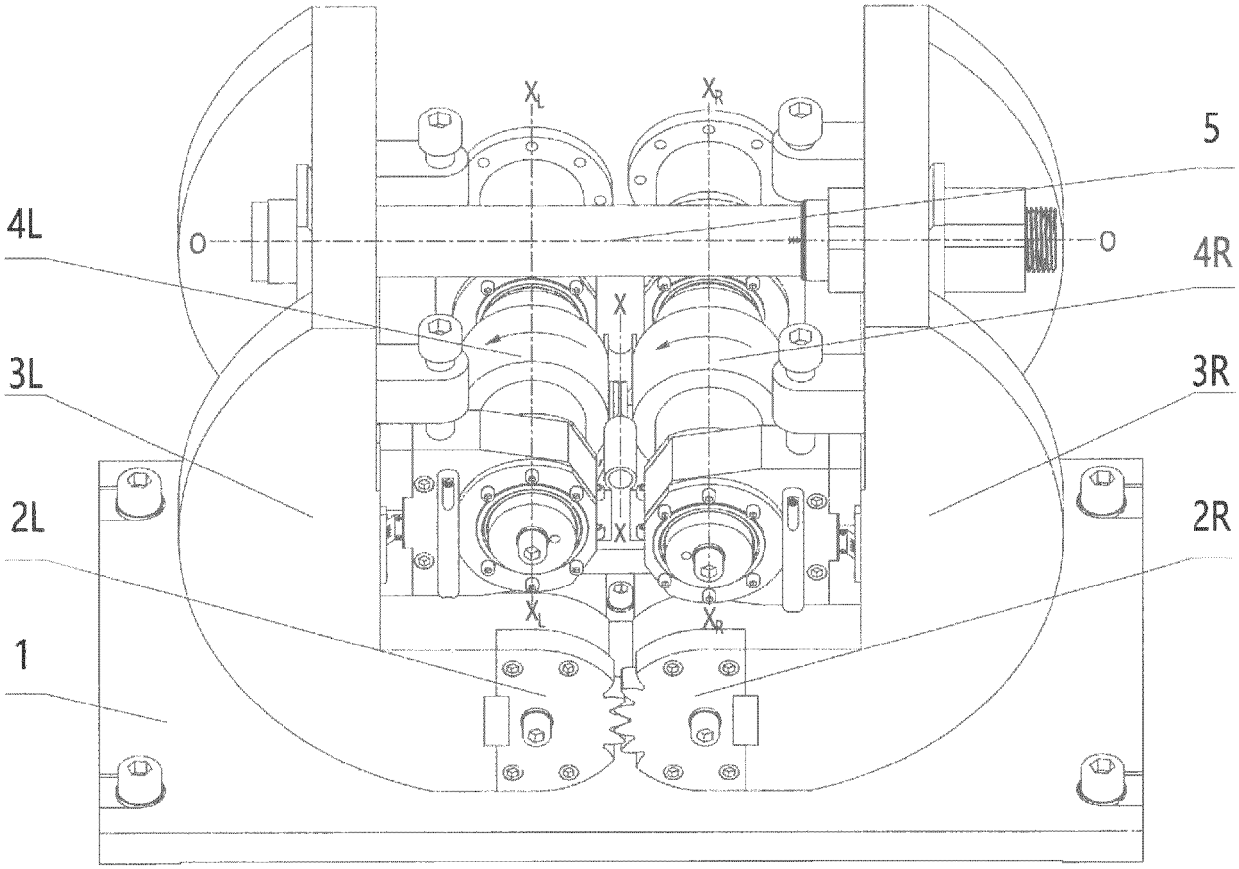

Fig. 1

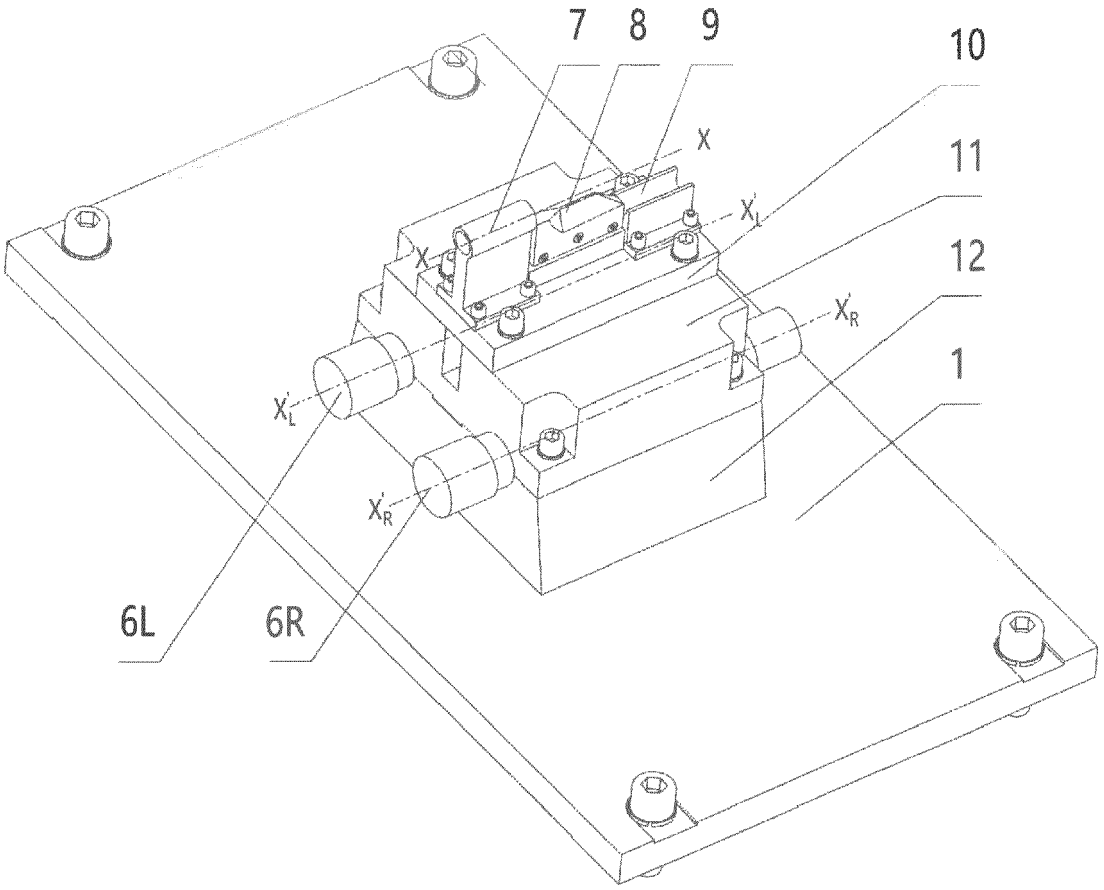

Fig. 2

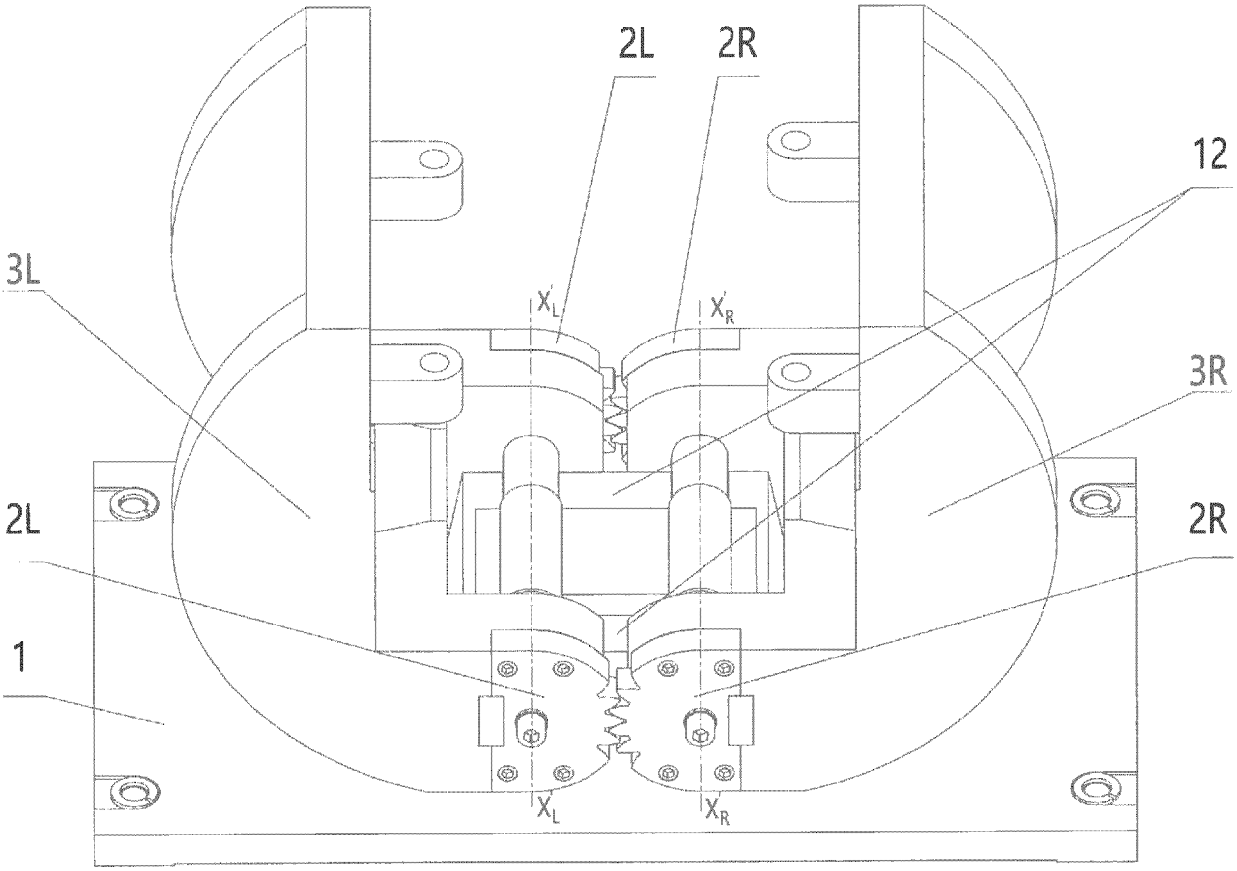

Fig. 3

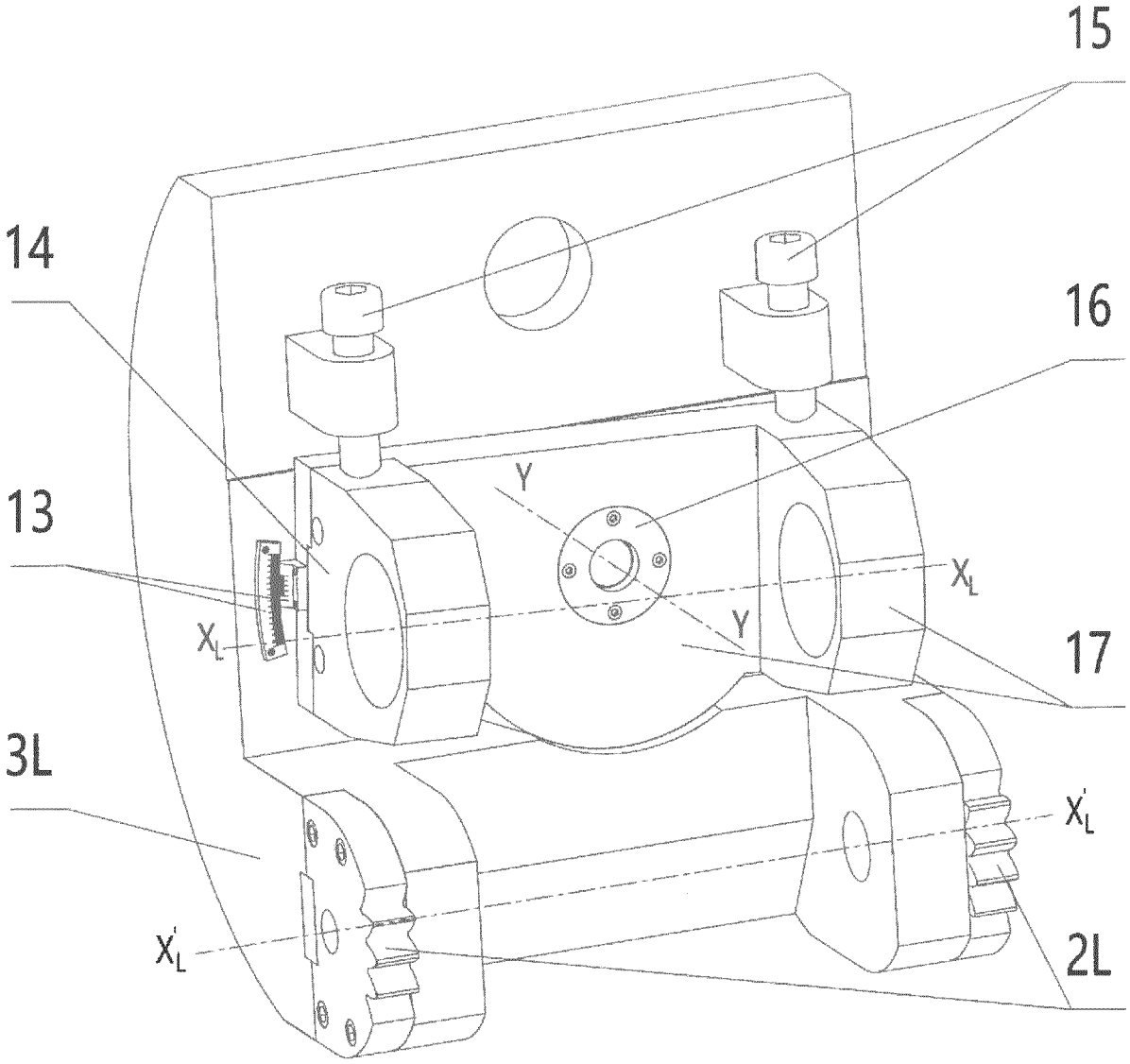

Fig. 4

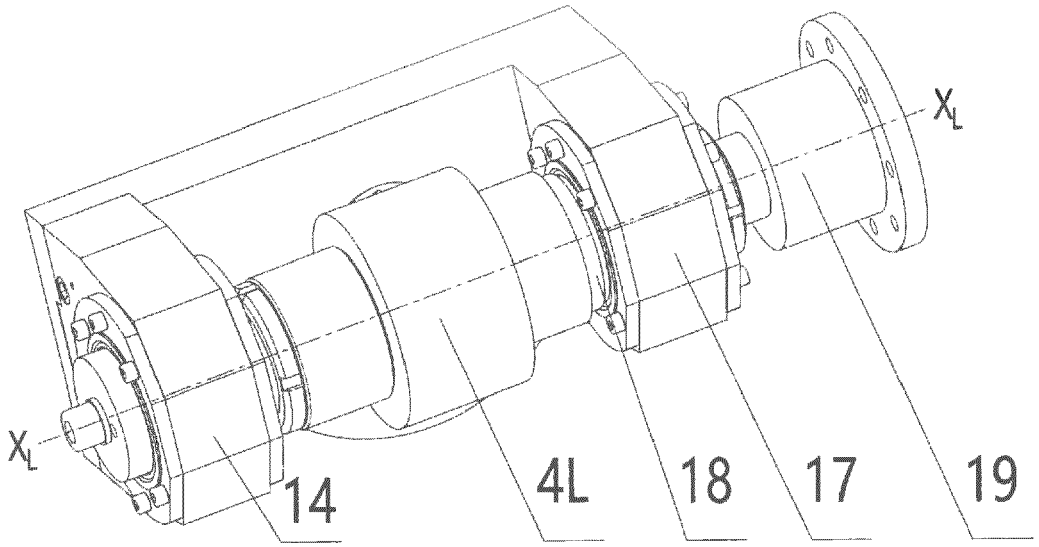

Fig. 5

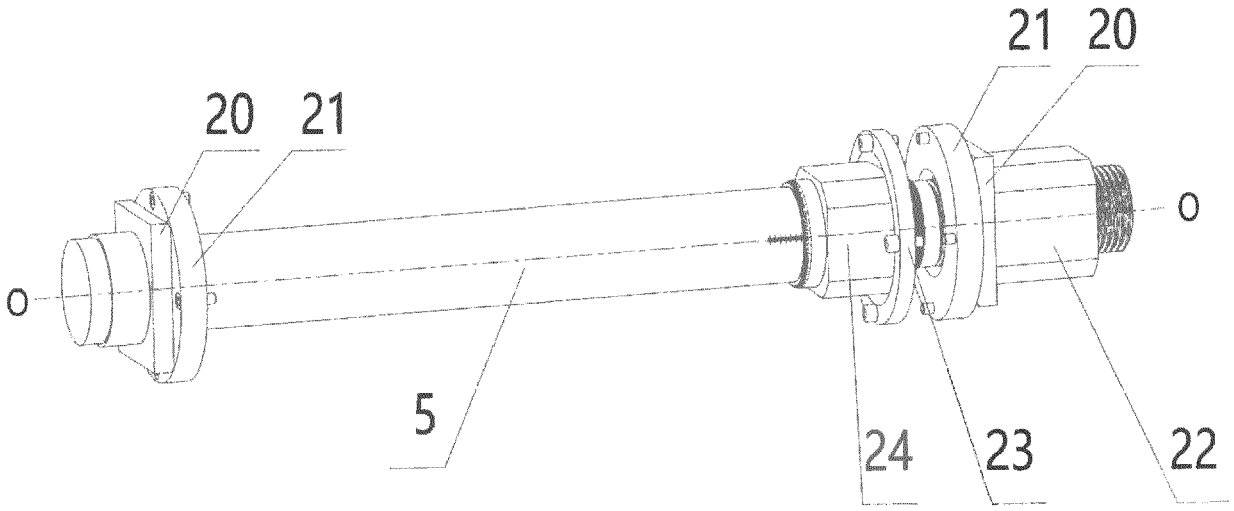

Fig. 6

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 20 18 0751

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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EUROPEAN SEARCH REPORT

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