Aug. 6, 1935. H. H. WOOD 2,010,211

ROLLING MILL

Filed Nov. 15, 1933 2 Sheets-Sheet 1

Fig. 1

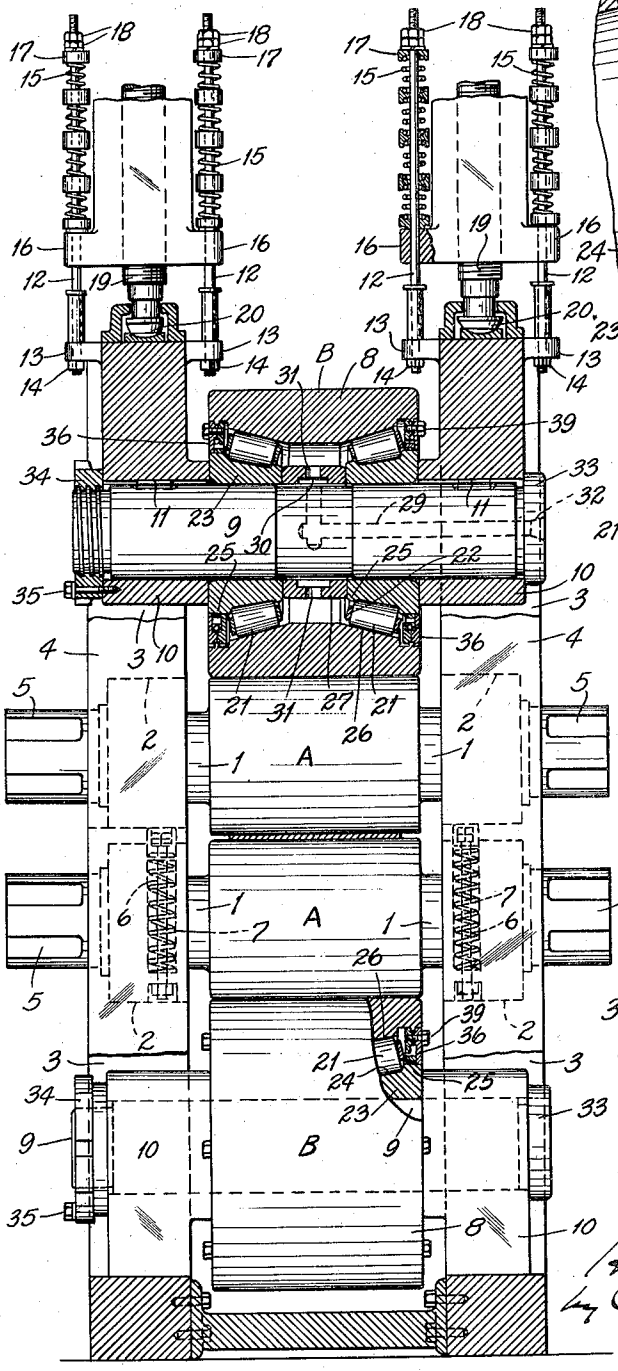


Fig. 2.

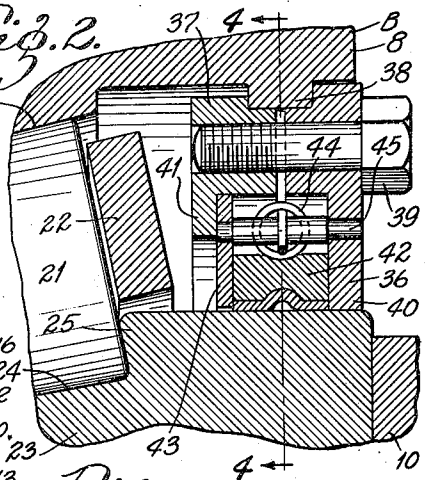


Fig. 3.

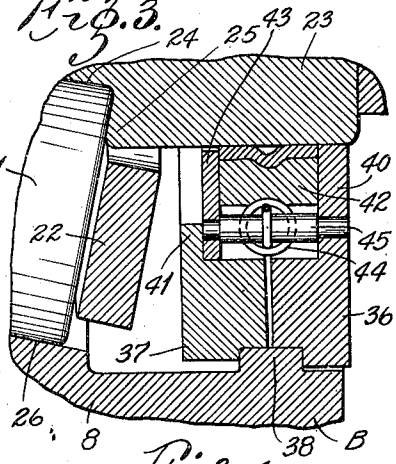
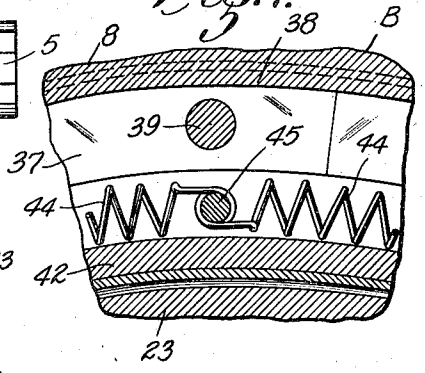


Fig. 4.



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Fig. 5.

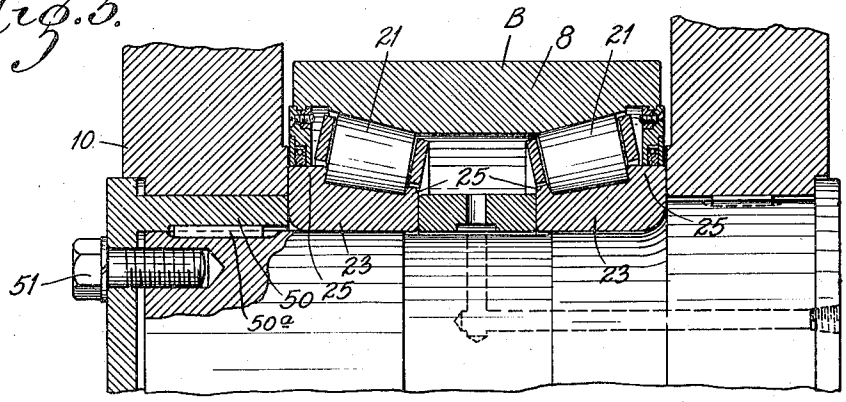


Fig. 6.

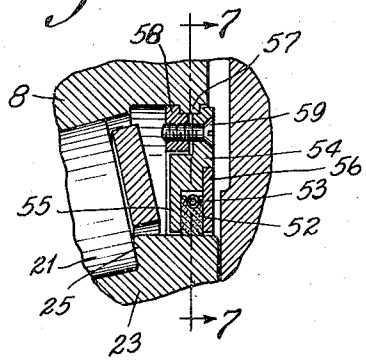
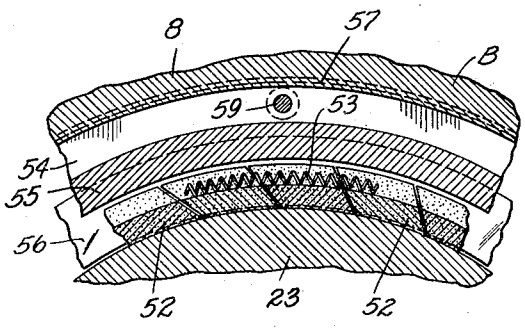


Fig. 7.



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Patented Aug. 6, 1935 2,010,211

UNITED STATES PATENT OFFICE

2,010,211

ROLLING MILL

Henry H. Wood, Canton, Ohio, assignor to The Timken Roller Bearing Company, Canton, Ohio, a corporation of Ohio

Application November 15, 1933, Serial No. 698,104

6 Claims. (Cl. 80—38)

This invention relates to rolling mills of the type wherein the pressure on the working rolls is relieved by backing or supporting rolls that are mounted on roller bearings. The principal objects of the invention are to dispense with the use of separate cups for such roller bearings; to provide for the proper positioning of the bearings; to provide for lubricating the bearings; to prevent the escape of lubricant from the bearings; and to provide for simplicity and cheapness of construction and compactness of design. The invention consists principally in the roller bearing backing roll and in the parts, combinations and arrangements of parts hereinafter described and claimed.

In the accompanying drawings, wherein like symbols refer to like parts wherever they occur,

Fig. 1 is a vertical view partly in section and partly in elevation of a four-high rolling mill embodying my invention,

Fig. 2 is an enlarged fragmentary axial section illustrating in detail the bearing closure at the end of the backing roll,

Fig. 3 is a view similar to Fig. 2, showing the manner of anchoring the retaining spring for the packing ring,

Fig. 4 is a transverse cross-section on the line 4—4 in Fig. 2;

Fig. 5 is a vertical longitudinal section through a roller bearing backing roll provided with closures and an adjusting device of modified form;

Fig. 6 is an enlarged fragmentary section through one end of the backing roll; and

Fig. 7 is a transverse section on the line 7—7 in Fig. 6.

Referring to the accompanying drawings, my invention is shown in connection with a four-high rolling mill comprising a pair of working rolls A arranged one above the other and a backing roll B for each working roll, the axes of all the rolls being approximately in the same vertical plane. The working rolls A have necks 1 that are journaled in suitable antifriction bearings (not shown) that are located in boxes 2 adapted to slide vertically in windows 3 provided therefor in the stands or end members 4 of the framework of the mill. The necks 1 of the working rolls A extend beyond the supporting boxes 2 therefor and are provided with wabbler teeth 5 adapted for cooperation with the usual wabbler drive member (not shown). The working rolls A are held in contact with the backing rolls B by means of spring devices mounted in the supporting boxes 2 therefor. As shown in Fig. 1, each of these spring devices comprises a plunger 6 mounted in a bore provided therefor in the box 2 at each end of one work roll and held in engagement with the adjacent box of the other working roll by means of a coil spring 7 that is sleeved on said plunger between the bottom of the recess therefor and the head of the plunger.

The upper and lower backing rolls B are similar to each other in construction. Each backing roll B comprises a heavy cylindrical shell 8, preferably of about the same length as the working rolls A. Each of said shells is supported by a shaft or beam 9 which extends through said shell and has its ends supported in boxes 10 that are adapted to slide vertically in the windows 3 of the roll stands 4 sufficiently for purposes of adjustment. The beam 9 is prevented from rotating in the boxes 10 by means of keys 11 that permit axial sliding movement of said beam in said boxes. The boxes for the lower backing roll rest on the bottoms of the windows in the roll stands; and the boxes for the upper backing roll are suspended from the tops of said roll stands by means of vertical rods 12 that extend through alined openings provided therefor in outstanding lugs 13 on said stands and said box members, respectively. The lower ends of the rods 12 are provided with nuts 14 that secure the lugs 13 of the boxes thereto; and springs 15 are sleeved on the upper portions of said rods between lugs 16 on the tops of the roll stands and washers 17 that are held on the rods by means of nuts 18. The top boxes for the backing rolls are adjusted vertically in the windows of the roll stands by heavy adjusting screws 19 that are threaded through vertical openings provided therefor in said roll stands and have swivel connections 20 at their lower ends with the tops of said boxes.

Between the shell 8, that constitutes each backing roll B, and the beam or shaft 9, that constitutes the support for said shell, are interposed roller bearings that enable the backing roll to rotate on its axis. The roller bearing construction of each backing roll B comprises two conical or taper roller bearings located one at each end of the backing roll. Each roller bearing comprises a circular series of conical bearing rollers 21 mounted in a suitable retaining cage 22. Said bearing rollers are interposed between the cylindrical shell 8 of the backing roll and a cone or inner bearing member 23 loose-fitted on the shaft or supporting beam 9 inside said shell. The cone 23 has a conical bearing surface or raceway 24, which tapers from the outer end of the cone towards the inner end thereof, and the usual annular thrust ribs 25 at the opposite ends of

said raceway. The inner periphery of the cylindrical shell 8 of the backing roll is provided with a conical band 26 adapted to function as the conical bearing surface or inner raceway for the bearing rollers of each roller bearing, thereby dispensing with the use of separate cups or outer raceway members for said bearings. A spacing ring 27 is sleeved on the shaft 9 of each backing roll between the cones 23 of the two bearings and serves to space said cones the desired distance apart.

The supporting shaft or beam 9 for each backing roll B is provided with an axial passageway 29 that extends inwardly from one end of said shaft and thence laterally and opens into an annular channel 30 in the spacing ring 27, which channel communicates through radial openings 31 in said ring with the space between the two bearings, thereby affording an easy and efficient way of lubricating them. The outer end of the passageway 29 is closed by means of a plug 32 that has threaded engagement with the shaft.

As shown in Fig. 1, the beam or supporting shaft 9 for each backing roll B is provided at one end with a head 33 which bears against the vertical face of the supporting box 10 therefor and thus prevents axial movement of said shaft in one direction. Axial movement of said shaft in the opposite direction is prevented by means of an adjustable stop collar 34 that is threaded on the other end of the shaft 8 in abutting relation to the supporting box 10 therefor. The collar 34 is held in its desired adjusted position by means of a cap screw 35 that passes through one of a number of holes provided therefor in said collar and is threaded into one of a number of holes provided therefor in the adjacent supporting box 10. By this arrangement, the tightening of the threaded collar 34 pulls the boxes 10, bearing cones 23 and spacing ring 27 together, and accordingly the adjustment of running clearance of the bearings depends on the length of said spacing ring. This ring may be accurately made to the exact length to give the proper bearing adjustment.

Suitable closures are required for preventing the escape of lubricant through the outer ends of the roller bearings. The lubricant closure or retaining means shown in Figs. 2 to 4, inclusive, comprises two annular plates 36 and 37, respectively, mounted in each end of the cylindrical shell of each backing roll opposite the outermost thrust rib of the cone of the roller bearing at said end of said shell. The two annular plates are arranged one on each side of an annular rib 38 in the inner periphery of the cylindrical shell of the backing roll and are held together in abutting relation to said rib by means of cap screws 39 that pass through the outer plate 36 and are threaded into the inner plate 37. The plates 36, 37 have inwardly extending flanges 40 and 41, respectively, the flange 40 of the outer plate 36 closely fitting the outer cone rib and the flange 41 of the inner plate 37 being spaced from said rib. A packing ring 42 is located between the inwardly extending flange 40 of the outermost plate 36 and an annular plate 43 interposed between opposing faces of the inwardly extending flange 41 of the innermost plate 37 and said packing ring. The packing ring 42 is held in engagement with the outer periphery of the cone rib by means of a garter spring 44 that encircles said packing ring and is anchored to the flange 40 of the outermost plate 36 and the annular plate 43 by means of one or more anchor pins 45.

In the modified construction shown in Fig. 5, the cones 23 and spacing ring 27 are clamped together between an annular shoulder at one end of the supporting beam or shaft 9 and a cylindrical cup 50 that is interposed between the other end of said shaft or beam and the opening provided therefor in the supporting box 10 for said other end of said shaft or beam. Said cup is secured to said supporting shaft or beam preferably by means of a key 50a. The inner end of the cup 50 bears against the adjacent bearing cone and the outer or closed end of said cup is provided with a series of openings adapted to receive cap screws 51 that are threaded into a similar series of openings in the adjacent end of the shaft or supporting beam for the backing roll. By this arrangement, tightening of the cap screws 51 causes the cones 23 and spacing ring 27 to be clamped together between the cup 50 and the shoulder at the opposite end of the shaft 9, thereby properly positioning the bearing rollers 21 relative to their inner and outer raceways endwise to bring their thrust ribs 25 in proper position relative to the bearing rollers 21 cooperating therewith.

The bearing closure, which is shown in detail in Figs. 6 and 7, comprises a segmental packing ring 52, which closely embraces the thrust rib at the large end of the cone. This segmental packing ring 52 is yieldably held in engagement with the thrust rib of the cone by means of a garter spring 53 that is seated in a groove provided therefor in the outer periphery of said packing ring. An annular plate 54 is located in the annular space between each end of the cylindrical shell of the backing roll and the thrust rib at the large end of the adjacent bearing cone. The annular plate 54 has an inwardly extending flange 55 on its inner face that is overlapped by an annular plate 56 fixed to the outer face of said annular plate 54, the plate 56 and flange 55 cooperating to form an annular channel for receiving the segmental packing ring 52. The annular plate 54 is arranged on one side of an annular rib 57 in the cylindrical shell 8 of the backing roll, and an annular plate 58 is arranged on the opposite side of said rib. The two plates 54 and 58 are clamped together on opposite sides of the rib 57 by means of screws 59.

The above described bearing closure constructions have been made the subject matter of a divisional application Serial No. 742,925 filed September 6, 1934.

The hereinbefore described arrangement has numerous advantages. It permits the cylindrical shell of the backing roll to function as the outer raceways for the two roller bearings, thereby dispensing with the use of separate outer raceway members and thus saving the cost thereof; it provides for an accurate bearing locating means; it provides proper lubrication for said bearings; and it provides a simple, efficient and quickly replaceable closure for preventing the escape of lubricant from and the entry of dust or other foreign matter into the ends of the roller bearings.

What I claim is:

1. A rolling mill comprising a hollow roll, a supporting member extending through said roll, and taper roller bearings for rotatably mounting the ends of said roll on said supporting member, each of said roller bearings comprising a tapered inner raceway member slidably mounted on said supporting member with its smaller end

disposed inwardly, and a single series of tapered bearing rollers interposed between said inner raceway member and said roll, said roll being directly supported on said bearing rollers and constituting a tapered outer raceway therefor, supports for the ends of said supporting member disposed in abutting relation to the outer ends of the inner raceway members, and means for moving said supports towards each other to adjust said bearings.

2. A rolling mill comprising a hollow roll, a supporting member extending through said roll, and roller bearings for rotatably mounting the ends of said roll on said supporting member, each of said roller bearings comprising a conical inner raceway member slidably mounted on said supporting member with its smaller end disposed inwardly, and conical bearing rollers mounted on said conical inner bearing member, said hollow roll being formed with a conical surface adapted to function as a conical outer raceway for said conical bearing rollers, supports for the ends of said supporting member, supports for the ends of said supporting member disposed in abutting relation to the outer ends of the inner raceway members, and means for moving said supports towards each other to adjust said bearings.

3. A rolling mill comprising a hollow roll, a shaft extending through said roll, and roller bearings for rotatably supporting the ends of said roll on said shaft, each of said roller bearings comprising a conical inner raceway member slidably mounted on said shaft with its smaller end disposed inwardly, a single series of conical bearing rollers mounted on said conical inner raceway member, and a conical outer raceway portion formed in said roll and for cooperation with said conical bearing rollers, a spacing ring sleeved on said shaft between the conical inner raceway members of said bearings, boxes for supporting the ends of said shaft beyond said roll, and means located at one end only of said shaft for drawing said boxes towards each other into abutting relation to said inner raceway members to obtain a proper adjustment of said bearings.

4. A rolling mill comprising a hollow roll, a shaft extending through said roll, supports for said shaft, and two roller bearings for rotatably supporting said roll on said shaft, each of said roller bearings comprising a conical inner raceway member mounted on said shaft, a single series of conical bearing rollers mounted on said conical inner bearing member, and a conical outer raceway portion formed in said roll for cooperation with said conical bearing rollers, said conical inner raceway member being provided with thrust ribs at the ends of its raceway and being slidably mounted on said shaft with its smaller end disposed inwardly.

5. A rolling mill comprising a hollow backing roll, a shaft extending through said backing roll, taper roller bearings interposed between said shaft and the ends of said backing roll, each of said roller bearings comprising a tapered inner raceway member slidably mounted on said shaft with its smaller end disposed inwardly, a single series of tapered bearing rollers cooperating with said tapered inner raceway member, and a tapered band formed in said hollow backing roll and constituting an outer raceway for said bearing rollers, boxes for supporting said shaft beyond the ends of said backing roll and having longitudinally slidable connections with said shaft, a spacing ring slidable on said shaft between the small ends of the inner raceway members of said roller bearings, said shaft having an annular shoulder thereon in abutting relation to the outer end of one of said supporting boxes, and a member threaded on said shaft in abutting relation to the outer end of the other of said supporting boxes.

6. A rolling mill comprising a hollow backing roll, a shaft extending through said backing roll, taper roller bearings interposed between said shaft and the ends of said backing roll, each of said roller bearings comprising a tapered inner raceway member slidably mounted on said shaft with its smaller end disposed inwardly, a single series of tapered bearing rollers cooperating with said tapered inner raceway member, and a tapered band formed in said hollow backing roll and constituting an outer raceway for said bearing rollers, boxes for supporting said shaft beyond the ends of said backing roll and having longitudinally slidable connections with said shaft, a spacing ring slidable on said shaft between the small ends of the inner raceway members of said roller bearings, said shaft having an annular shoulder thereon in abutting relation to the outer end of one of said supporting boxes, and a member interposed between said shaft and the other of said supporting boxes and adjustable longitudinally of said shaft to bring its inner end in abutting engagement with the inner raceway member of the roller bearing located adjacent thereto.

HENRY H. WOOD.

CERTIFICATE OF CORRECTION.

Patent No. 2,010,211. August 6, 1935.

HENRY H. WOOD.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 6, after "inwardly" and before the period, insert the comma and words , a spacing ring sleeved on said shaft between the conical inner raceway members of said bearings, boxes for supporting the ends of said shaft beyond said roll, and means located at one end only of said shaft for drawing said boxes towards each other in abutting relation to said inner raceway members to obtain a proper adjustment of said bearings; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 17th day of September, A. D. 1935.

Leslie Frazer

(Seal) Acting Commissioner of Patents.