Dec. 10, 1929. O. B. LINDQUIST 1,739,156

FOUR-HIGH MILL

Filed April 6, 1927 3 Sheets-Sheet 1

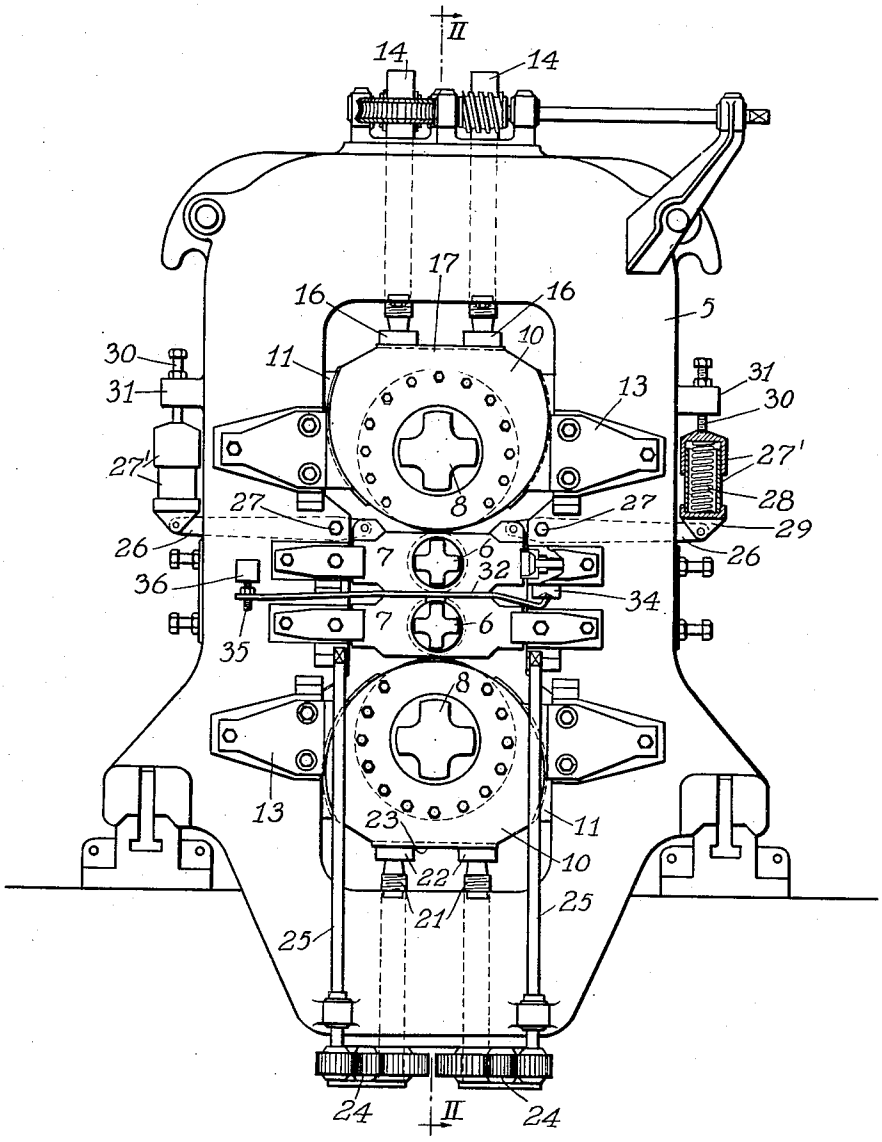

FIG. 1.

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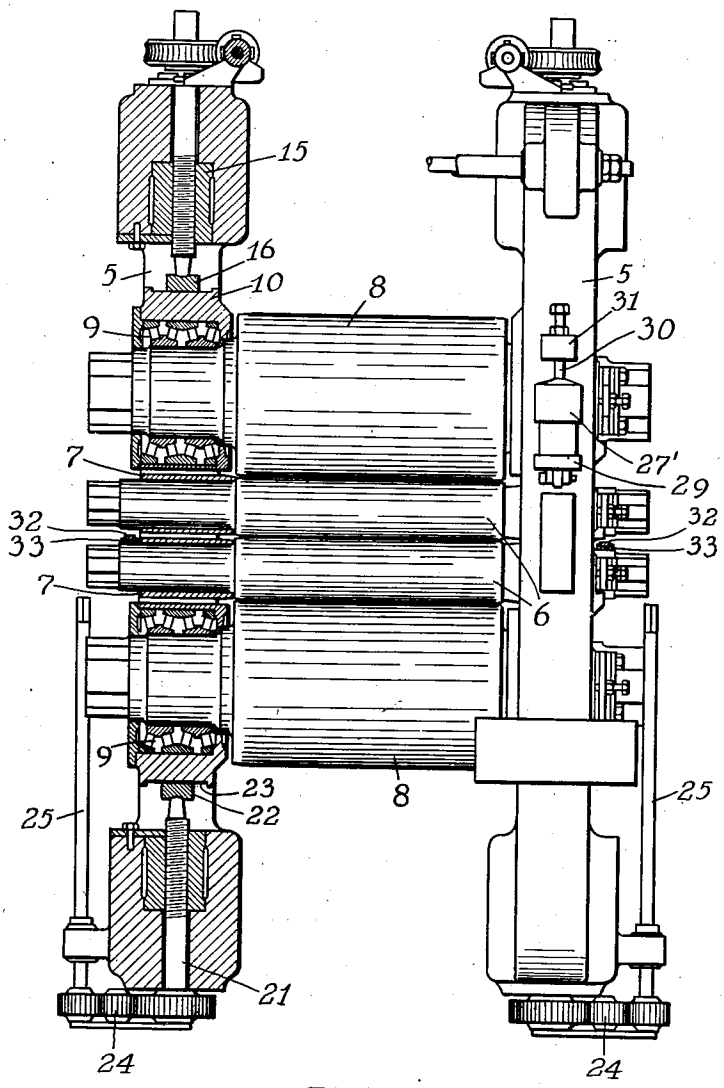

FIG. 2.

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FIG. 3.

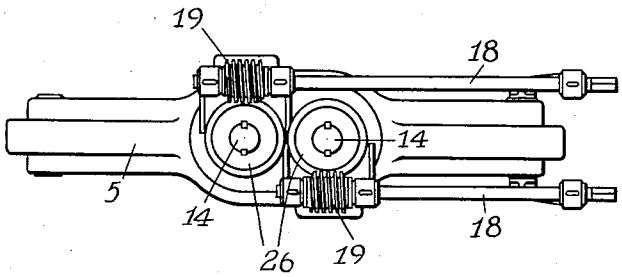
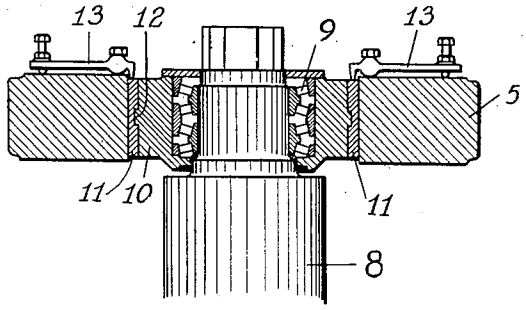


FIG. 4.



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UNITED STATES PATENT OFFICE

OTTO B. LINDQUIST, OF TARENTUM, PENNSYLVANIA, ASSIGNOR TO ALLEGHENY STEEL COMPANY, OF BRACKENRIDGE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

FOUR-HIGH MILL

Application filed April 6, 1927. Serial No. 181,448.

This invention relates to improvements in rolling mills of the four high type.

Mills of this type generally employ a pair of working or reducing rolls of relatively small diameter which form the roll pass and relatively large backing rolls so arranged as to engage the reducing rolls on opposite sides thereof and in the plane including the reducing roll axes in order to prevent undue deflection of the reducing rolls during rolling.

In mills of this type it is absolutely essential to maintain the axes of the backing rolls parallel to those of the reducing rolls, for it will be apparent that any crossing or misalignment of such axes will be fatal.

An object of this invention is to provide a four high mill of such construction and arrangement as to obtain proper positioning of the roll axes at all times.

A further object is to provide a four high mill of such construction as to permit ready adjustment and positioning of the backing rolls during rolling.

A still further object is to provide a four high rolling mill of improved construction and which will operate with a minimum of roll neck friction.

These and other objects which will be apparent to those skilled in this particular art are accomplished by the mill illustrated in the accompanying drawings, in which Figure 1 is a view in side elevation of a four-high rolling mill constructed in accordance with this invention. Fig. 2 is a similar view of the same looking from the left in Fig. 1 and partly in section on the line 2—2 of Fig. 1. Fig. 3 is a top plan view of one of the roll housings and Fig. 4 is a horizontal sectional view through a bearing and cradle of one of the backing rolls.

This invention has been shown in connection with a four-high mill but it will be apparent that various features thereof are applicable to mills of other types.

The mill illustrated includes the usual relatively small reducing rolls and their cooperating relatively large diameter backing rolls for preventing any undue deflection in the reducing rolls during rolling. It is necessary and has hitherto been found to be extremely difficult to align the axes of the backing rolls with those of the reducing rolls and the present invention provides a mechanism which, as illustrated, forms part of the bearing supports for the backing rolls capable of being so operated, during rolling if necessary, as to change the axial position of either or both of the backing rolls should they for any cause be deflected from their true alignment with the reducing rolls. Improved means are also provided for holding each reducing roll in contact with its backing roll to prevent the necessity of jumping the rolls when the work is entered in the pass.

The invention is shown as applied to a four-high rolling mill having roll stands or housings 5 in which the relatively small reducing rolls 6 are mounted in vertically movable bearing boxes 7. The larger backing rolls 8 are supported in vertically movable bearings 9 which are illustrated as roller bearings but which may obviously be of any desired type. Each roller bearing is housed in a bearing box 10 mounted in a supporting cradle 11 by a tongue and slot connection 12, or by some other suitable method for retaining the bearing box 10 in the supporting cradle 11, for rotatable movement about a center offset with respect to the associated roll center. The cradles are held in place in the roll stand by retainers 13, or by some other suitable method for retaining the entire bearing unit consisting of bearing 9, bearing box 10 and supporting cradle 11 in the housing 5.

Mechanism is provided for the purpose of enabling the bearing boxes 10 to be shifted about their centers for the purpose of aligning the roll axes. This mechanism forms a part of the screw-down device for the top backing roll. A similar mechanism is provided for the lower backing roll. That provided for the upper roll consists of the threaded rods 14 which are threaded through suitable blocks 15 mounted in the roll housing and which engage contact members 16 on the flattened top 17 of each upper bearing box and on opposite sides of the center of rotation thereof so that by applying pressure to one contact member and relieving the other member from pressure the bearing box 10

will be caused to rotate about its center and thus shift the roll axis laterally in the desired direction. The bearing box 10 rotates in the supporting cradle 11, said cradle having the same contour as the bearing box 10 on the one side and the window of housing 5 on the opposite, thereby providing a bearing surface equivalent to the projected area and eliminating a line contact on window of housing 5, which would be secured without the use of supporting cradle 11. The screw-down shafts 14 are separately rotatable by hand through the medium of worm shafts 18 having worms 19 engaging worm wheels 20 keyed to the upper ends of the respective shafts. The lower bearing housing is operated by similar threaded shafts 21 engaging contact members 22 mounted on the flattened bottom 23 of the lower bearing box and these shafts are separately operated through separate reduction gears 24 by means of manually rotatable shafts 25.

It will be apparent that the backing rolls can thus readily be adjusted so that their axes will be in the plane including the reducing roll axes. It will also be apparent that should the upper backing roll, for example, from wear or any other cause have its axis shifted slightly out of the plane including the reducing roll axis, such misalignment can be instantly corrected, even during rolling, by first backing off one or the other of the screw-down shafts 14 and then screwing up the other shaft 14 to cause a sufficient rotation of the bearing box 10 to overcome the misalignment of the roll axes. It will be understood that such movement will be very small and that by means of such an adjustment the roll axes can be maintained at all times in absolute parallelism in a common plane. It will be apparent that the backing rolls can readily be adjusted so that their axes will be parallel and in the same vertical plane, not including the reducing roll axes, said reducing rolls adjusted independently as shown so that their axes will be parallel and in the same vertical plane. For example, should it be desirable to set the reducing rolls slightly ahead or behind the backing up rolls, the axes of the reducing rolls would be parallel and in the same vertical plane and the axes of the backing up rolls would be parallel and in the same vertical plane but the axes of the reducing rolls and the axes of the backing up rolls would not be in the same or common vertical plane. By means of the adjusting mechanism incorporated herein the roll axes can be maintained at all times in absolute parallelism in a common plane, or if so desired, can be maintained at all times in absolute parallelism, the backing roll axes in a common plane and the reducing rolls in a common plane, but these two planes not common to each other.

It is the practice in some types of four-high mills to support the upper backing roll by the upper reducing roll and in turn to yieldingly support the upper reducing roll so that it will not be necessary to jump these rolls when the work is entered in the roll pass. It is also common to yieldingly hold the lower reducing roll in contact with its backing roll. In the mill illustrated the upper reducing roll bearing box 7 is secured at each upper corner to the inner ends of levers 26 which are pivoted to the roll housing by means of pivot pins 27. The outer end of each lever is connected to mechanism for yieldingly forcing that end of the lever downwardly and thus raising the associated bearing housing so as to yieldingly support the reducing roll and its backing roll. This mechanism includes a pair of telescoping cylinders 27′, each of which is yieldingly held in distended position by a helical spring 28 mounted within it and engaging the inner end of the outer cylinder 27 at its top and a spring seat 29 mounted on the projecting end of the lever 26, at the bottom. Means such as an adjusting set screw 30, mounted in a supporting bracket 31 is provided for positioning the upper cylinder 27 so that the associated spring 28 will press upon the outer end of the lever 26 with sufficient force to maintain the upper reducing roll and its backing roll in position, with the contact blocks 16 in contact with the hold down screws 14.

The lower reducing roll is yieldingly held in contact with its backing roll by means of two flat leaf springs 32. One of these springs bears on top of one roll neck while the other spring bears on top of the other roll neck. A spring seat 33 is interposed between each spring and its roll neck and one end of each spring is bent up and engages a fulcrum block 34. The other end of each spring is held in proper adjusted position by means of an adjustment screw 35 which has its upper end resting in contact with a contact block 36 secured to the housing.

It will be seen that I have produced a four-high mill of such construction that the various rolls can be readily aligned and should misalignment occur alignment can immediately be restored without the necessity of shutting down the mill.

Although I have described but one embodiment of my invention it will be readily understood that various changes, additions, omissions and substitutions may be made therein without departing from the spirit of the invention or the scope of the appended claims.

What I claim as new and useful and desire to secure by Letters Patent is:

1. The combination in a rolling mill, of a reducing roll, a backing roll, rotatably mounted boxes within which the backing roll is journaled and means for rotating said boxes about a center eccentric to the center of said backing roll to shift the axis of said backing

roll with relation to the axis of said reducing roll.

2. The combination in a rolling mill, of a reducing roll, a backing roll, rotatably mounted boxes within which the backing roll is journaled and means for independently rotating said boxes about a center eccentric to the center of said backing roll to shift the axis of said backing roll with relation to the axis of said reducing roll.

3. The combination in a four high mill, of a pair of reducing rolls, a pair of backing rolls, a rotatably mounted box for each neck of one of said backing rolls and means for rotating said boxes about centers eccentric to the center of said backing rolls to shift the axes of said backing rolls with relation to the axes of said reducing rolls.

4. In a four high mill, a pair of reducing rolls, a pair of relatively large backing rolls, supporting means for each neck of at least one of said backing rolls and rotatable about a center offset from the roll center and mechanism for independently rotating said supporting means.

5. In combination with the housings of a four high mill, a pair of reducing rolls, a pair of backing rolls, a box rotatable within each housing and within which the necks of the upper backing roll are mounted and means for either successively or simultaneously rotating said boxes about centers eccentric to the axis of the associated backing roll to adjust the axis of the backing roll so supported.

6. The combination with the housings of a four-high mill, of a pair of reducing rolls, upper and lower backing rolls, a pair of boxes for supporting the upper backing roll, said boxes being rotatable about centers offset with relation to the backing roll axis, a pair of screw-downs for each box and means for supporting the upper backing roll by the upper reducing roll and for yieldingly maintaining said boxes in contact with the screw-downs.

7. The combination with a roll of a rolling mill, of bearings for said roll, a box for each of the bearings and each of which is rotatable about a center offset from the roll center and means for rotating each box to change the angularity of the roll axis.

8. In a four-high mill having a pair of reducing rolls and a pair of backing rolls, rotatable boxes within which the bearings for the backing rolls are mounted, the centers of rotation of said boxes being offset from the centers of the rolls mounted therein and means for rotating said boxes to align the rolls supported thereby with the reducing rolls.

9. In a four-high mill having a pair of reducing rolls and a pair of backing rolls, housings, a box rotatably and slidably mounted within each housing, the bearings for the upper backing roll being mounted in said boxes and said boxes being rotatable about centers eccentric to the axis of said roll, screws for limiting the upward movement of said boxes and for rotating the same, means for yieldingly supporting the upper of the reducing rolls and through it, the upper backing roll and for yieldingly holding the boxes in contact with said screws.

10. In a rolling mill having housings each provided with a window, a pair of cradles mounted to slide in each window, a box mounted for rotation within each pair of cradles, a roll neck bearing carried in each box, a roll journaled in said bearing with its axis offset from the center of rotation of said box and means for rotating said boxes within said cradles.

In testimony whereof, I have hereunto subscribed my name this 29th day of March, 1927.

OTTO B. LINDQUIST.