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Maltby

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[54] **ROLLING MILLS**

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[52] **U.S. Cl.** **72/239**

[51] **Int. Cl.** **B21b 31/08**

[58] **Field of Search** 72/238, 239

[56] **References Cited**

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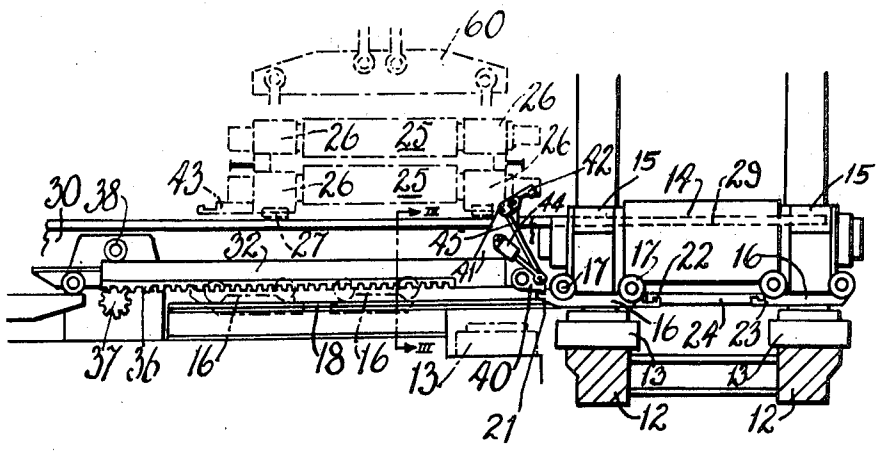
[57] **ABSTRACT**

A roll change rig for a four-high plate mill stand consists of a beam which can be driven towards and away from the stand and which has two separate couplings, one for connection to a work roll and the other for connection to the lower back-up roll. There are separate rolls for the lower work roll and lower back-up roll, on which the respective roll may be moved through the stand and into a roll change area, by operation of the beam. If the stand has hydraulic roll gap adjustment, the rig includes a trolley which can run on the back-up roll rails, which is driven by the roll change beam, and which carries lifting means for lifting a piston and cylinder assembly from the mill.

10 Claims, 5 Drawing Figures



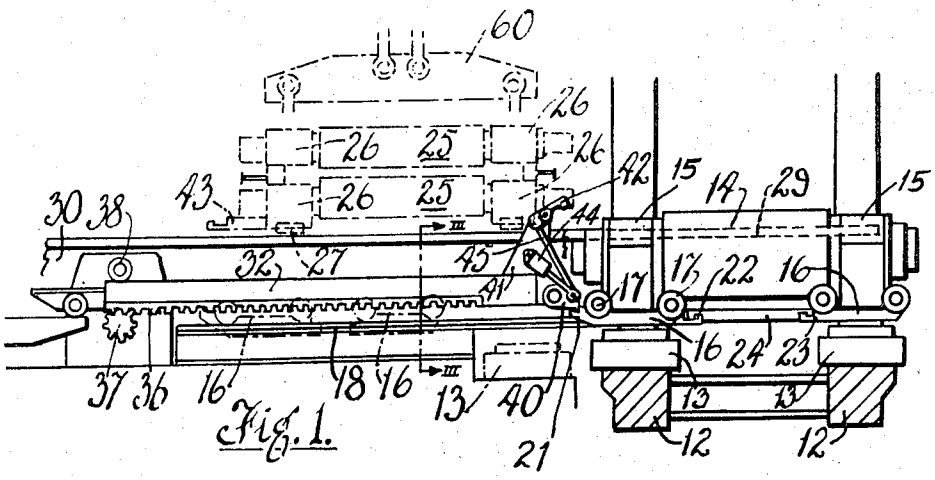


Fig. 1.

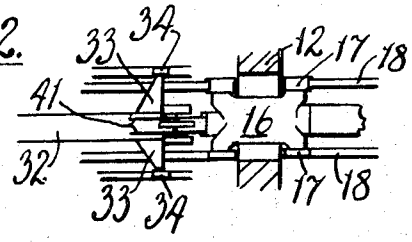


Fig. 2.

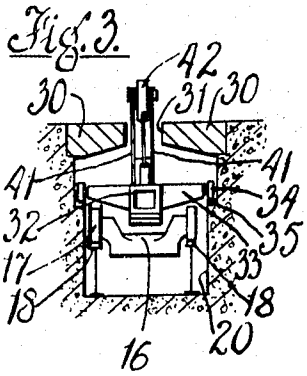


Fig. 3.

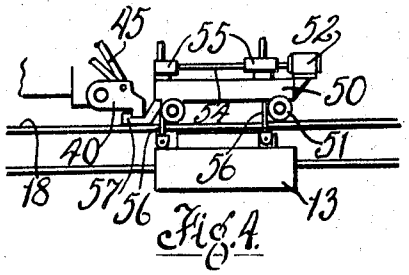


Fig. 4.

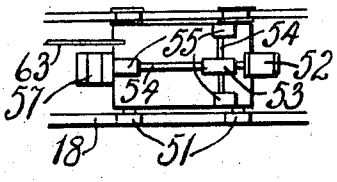


Fig. 5.

ROLLING MILLS

This invention relates to rolling mills for rolling metal and is particularly concerned with a four-high mill stand having work rolls supported or backed up by back-up rolls.

In all rolling mills, there is a need to be able to remove the work rolls with or without the back-up rolls easily and quickly, in order to minimise the down-time of the mill. Much thought has been given to this problem and many ingenious arrangements provided for replacing the rolls expeditiously. However, normally, independent mechanisms are required for the removal of the work rolls on the one hand and the back-up rolls on the other. This complicates the rolling mill equipment, causes further congestion in the limited space available at the roll change side of the mill, and adds to the expense.

In accordance with one aspect of the present invention, a roll change assembly for a four-high rolling mill stand having a pair of work rolls, each supported by a back-up roll, comprises a mechanism located on the roll change side of the stand and mounted for movement towards, and away from, the stand, and connection means on the mechanism for attachment to either a work roll, or a backup roll, whereby a roll or rolls may be moved into or out of the stand by the mechanism.

Where the rolling mill stand is a so-called "hydraulic mill" with hydraulic piston and cylinder assemblies in the housings to act on the roll stack and to control the roll gap, there is the further complication of having to remove from time to time the hydraulic piston and cylinder assemblies from the housings for inspection, servicing, or replacement. For that purpose, the roll change assembly may include a trolley arranged to be coupled to the roll change mechanism and carrying lifting means adapted to be connected to, and to lift, a piston and cylinder assembly, whereby a piston and cylinder assembly may be lifted free of the housing and then moved out into the roll change area.

The invention will be more readily understood by way of example from the following description of a roll change assembly in accordance therewith, reference being made to the accompanying drawings, in which

FIG. 1 is a side sectional view of part of the mill and the roll change assembly,

FIG. 2 is a plan of a part of the mill and roll change assembly of FIG. 1,

FIG. 3 is a section on the line III—III of FIG. 1, and

FIGS. 4 and 5 are respectively a side view and a plan view of a trolley for removal of a hydraulic piston and cylinder assembly.

FIG. 1 of the drawings illustrates only the lower part of the rolling mill, the two spaced housings being indicated at 12. Each housing 12 carries at the bottom of the housing window a piston and cylinder assembly 13. The lower back-up roll is shown at 14, the roll necks being carried in chocks 15 sliding in the housing windows. Chocks 15 are seated on sledges 16, each of which has wheels 17 designed to run on rails 18 (FIG. 2), which extend continuously between the two housings and, at the roll change side of the mill, in a pit 20 in the floor (FIG. 3). During operation of the mill, the sledges 16 are engaged by the piston and cylinder assemblies 13 and are raised to bring the wheels 17 out of contact with the rails 18. For back-up roll change, however, the pistons of the assemblies 13 are withdrawn downwardly allowing the sledge wheels 17 to become seated on the rails. The left-hand sledge 16, as viewed in FIG. 1, has at the left-hand end a hook 21 and at the right-hand end a second hook 22 at a lower level. Similarly, the right-hand sledge 16 has a hook 23 at the left-hand end at the same level as the hook 22. A connecting bar 24 has hooks at each end to engage with the hooks 22, 23 and thereby to permit both sledges 16 to be withdrawn together.

The work rolls, which are shown in broken line at 25 in the roll change position, are normally located in the mill above the bottom back-up roll 14 and with their chocks 26 sliding in the housing windows. Each of the chocks 26 of the lower work roll 25 is provided with a pair of spaced roller devices 27, each of which, in the form shown, is constituted by a series of freely rotatable rollers. The housings 12 carry rails 29 which project into the housing windows and which extend between the two housings. These rails are at the floor level and beyond the rails there are provided for carrying the rollers 27 removable deck plates 30 (FIG. 3) mounted over the pit 20, but leaving a gap 31 between them.

The roll change assembly itself consists of a box-section beam 32 supported by wings 33, which carry at their ends wheels 34 running on tracks 35 which are supported on ledges in the sides of the pit 20. On its underside, the beam 32 carries a rack 36, which meshes with a driven pinion 37. The rack is held in mesh with the pinion by a roller 38 bearing on the upper side of the beam 32. At the end nearer the mill, the beam 32 carries a pivoted latch 40, adapted to engage with the hook 21 as shown in FIG. 1. The beam 32 also carries two plates 41 which project upwardly between the deck plates 30 and carry a second latch 42 to engage with a hook formed on a forward projection 43 of the left-hand bottom work roll chock. The plates 41 carry a small hydraulic cylinder 44 which is connected to the lower latch 40 and which, when actuated, lifts that latch. Latch 40 is also connected by a coupling 45 to the latch 42, so that, when latch 40 is lowered, latch 42 is raised, and vice versa.

FIG. 4 and 5 illustrate a trolley for removal of a control cylinder 13. It comprises a platform 50 mounted on wheels 51 designed to run on the rails 18. Platform 50 supports a motor 52 driving, through gear box 53 and shafts 54, three gears 55 acting on vertical lifting rods 56 which can be coupled to the cylinder 13 as shown in FIG. 4. The trolley has a central hook 57 to couple with latch 40.

For removal of the work rolls, the piston and cylinder assemblies 13 are operated to lower the roll stack, until the roller devices 27 seat on the work roll change rails 29 located between the housings 12 and the weight of the work rolls are supported by those rails. Meanwhile, the upper back-up roll is latched in its upper position. The beam 32 is driven towards the right to the position shown in FIG. 1 and the latch 42 is operated by the cylinder 44 to engage with the hook 43. The drive for the pinion 37 is then actuated to withdraw the beam 32 and with it the pair of work rolls 25, the roller devices 27 running first on the housing rails 29 and then on the removable deck plates 30. When the work rolls have been brought into the position shown in chain line in FIG. 1, they may be removed, as by a lifting beam, such

as that indicated diagrammatically at **60.** A new pair of work rolls may be introduced into the mill by reversing the sequence of operations just described.

For the removal of the bottom back-up roll **14,** the work rolls having been previously removed, the cylinders **13** are again operated to lower the roll **14** until the wheels **17** of the sledges **16** engage the rails **18.** Latch **40** is operated to engage hook **21** and, after the deck plates **30** have been removed, the beam **32** is withdrawn again to the left to draw the roll **14** into the pit **20,** from which it may be lifted off the sledges **16** by the lifting beam **60.** Again, a replacement back-up roll may be inserted in the mill by following the same sequence in the reverse order.

If both back-up rolls are to be removed, spacers are placed on the chocks of the lower back-up roll **14** after removal of the work rolls. The upper back-up roll is then lowered on to the spacers and the two rolls are removed together in the manner described above.

In order to remove the left-hand piston and cylinder assembly **13,** the sledges **16** are moved into parking positions in the pit **20** as shown in chain line in FIG. **1** and the trolley of FIGS. **4** and **5** placed on the rails **18** to the left of the mill. The trolley is coupled to the beam **32** by the latch **40** and moved by the beam into a position over the left-hand assembly **13.** Motor **52** is operated to lower the rods **56** until they can be attached to the cylinder. When the assembly **13** has been raised by reverse operation of the motor **52,** the beam **32** is withdrawn to the left to bring the assembly out of the mill. It is then lowered into the position shown in chain line in FIG. **1,** the latch **40** disengaged, the beam **32** moved to the left, a hinged section of the rails **18** hinged away, and the assembly removed by the lifting beam.

Similarly, for the removal of the right-hand assembly **13,** the left-hand assembly having been previously removed, the trolley of FIGS. **4** and **5** is placed on the rails **18** and coupled to the beam **32** by a light-weight link indicated schematically at **63** in FIG. **5.** This link is sufficiently long to extend between the end of beam **32** in the position shown in FIG. **1** and the right-hand assembly **13.** The trolley is then driven by the beam **32** to the position above the right-hand assembly **13** and the previously described sequence of operations repeated to remove that assembly first from the mill to the cylinder removal area to the left of the mill, and then lift it away by the lifting beam **60.**

It will be appreciated that a number of modifications are possible in the arrangement as described. For example, the mechanism may be modified to enable the entire stack of rolls — the two back-up rolls and the two work rolls — to be removed and/or replaced in one operation, or similarly for the assembly of bottom work back-up roll and two work rolls.

In accordance with the provisions of the patent statutes, I have explained the principle and operation of my invention and have illustrated and described what I consider to represent the best embodiment thereof.

I claim:

1. A roll change assembly for a four-high rolling mill stand having a pair of work rolls, each supported by a back-up roll, a roll change assembly comprising:

a roll displacer,

means on the roll change side of said stand for mounting said roll displacer for movement relative to said stand along a path parallel to the axes of said rolls,

means for driving said roll displacer along said path,

a first connection means carried by said roll displacer for attachment to a work roll in said stand,

a second connection means carried by said roll displacer for attachment to a back-up roll in said stand,

each of said connection means being movable between a connecting position and a non-connecting position, and

common actuating means for said first and second connection means,

said actuating means being movable between a first position, in which said first connection means is in said connecting position and said second connection means is in said non-connecting position, and a second position, in which said first connection means is in said non-connecting position and said second connection means is in said connecting position.

2. A roll change assembly according to claim **1** in which said roll displacer comprises a beam mounted on rollers for movement along said path and having a part which projects upwardly from the beam and which carries said first connection means.

3. A roll change assembly according to claim **2** in which said driving means comprises a rack carried lengthwise by said beam, and a drive pinion meshing with said rack.

4. The combination of a four-high rolling mill stand comprising:

a pair of housings,

a pair of work rolls, and

for each said work roll, a supporting back-up roll,

at least said back-up rolls being mounted in said housings for movement therein;

and a roll change assembly comprising:

a pit below floor level at the roll change side of said mill,

cover plates extending over said pit and separated by a slot extending away from said stand parallel to the axes of said rolls,

first support means extending between said housings and including said cover plates for supporting at least one of said work rolls during a roll change,

second support means extending at a lower level than said first support means, between said housings and into said pit to support a back-up roll during movement thereof into and out of the stand,

a roll displacing beam mounted on rollers for movement in said pit towards and away from said stand,

a projecting part carried by said beam extending upwards through said slot and out of said pit,

a first connection means carried by said projecting part above said cover plates, for attachment to a work roll when supported by said first support means, and

a second connection means carried by said beam below the level of said cover plates for attachment to a back-up roll when supported by said second support means.

5. The combination according to claim **4** in which the second support means comprise rails extending between the housings and into said pit.

6. The combination according to claim **4** in which

each of said first and second connection means includes a latch for coupling with a hook of said rolls, and

there is a piston and cylinder assembly for moving at least one of said latches between a connecting position and a non-connecting position.

7. The combination according to claim **5,** in which the lower back-up roll is carried on sledge means having wheels adapted to run on the rails of the second support means.

8. The combination of a four-high rolling mill stand comprising:

a pair of housings,

a pair of work rolls,

for each said work roll, a supporting back-up roll,

at least said back-up rolls being mounted in said housing for movement therein, and

a piston and cylinder assembly in each said housing for engagement with one of said back-up rolls and for roll gap adjustment; and a roll change assembly comprising:

first support means extending between said housings and into roll change area at the roll change side of said stand, for supporting at least one of said work rolls during roll change,

second support means similarly extending between said housings and into roll change area for supporting a back-up roll during movement thereof into and out of said stand,

a roll displacer located in said roll change area and mounted for movement towards and away from said stand,

first connection means on said roll displacer for attachment to a work roll when supported by said first support means,

second connection means on said roll displacer and at a level different from that of said first connection means for attachment to a back-up roll when supported on said second support means,

a trolley for movement on said second support means,

means for connecting said trolley to said roll displacer,

lifting means carried by said trolley, and

means for connecting said lifting means to one of said piston and cylinder assemblies,

whereby one said assembly may be lifted from off its said housing and then moved into said roll change area.

9. The combination according to claim **8** in which the lifting means comprise a plurality of screw jacks depending from the trolley and securable to a piston and cylinder assembly, and means for operating the jacks jointly.

10. The combination according to claim **8,** in which the second support means include rails extending between the housings and into the roll change area, and the trolley has wheels adapted to run on, and be supported by, those rails.

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