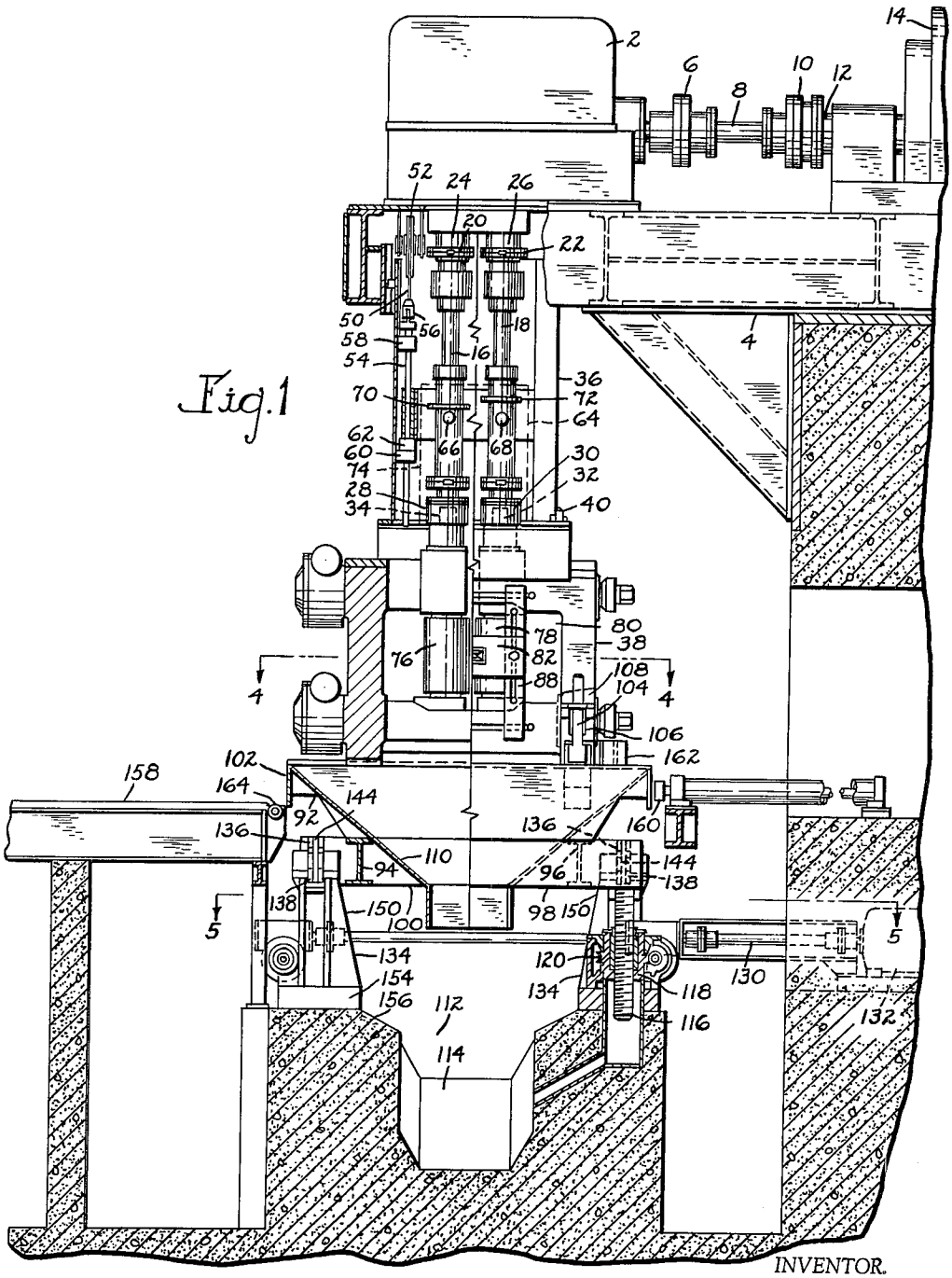
Dec. 14, 1965 W. J. HILL 3,222,901

ROLLING MILL

Filed July 19, 1962 4 Sheets-Sheet 1

Fig. 1



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ROLLING MILL

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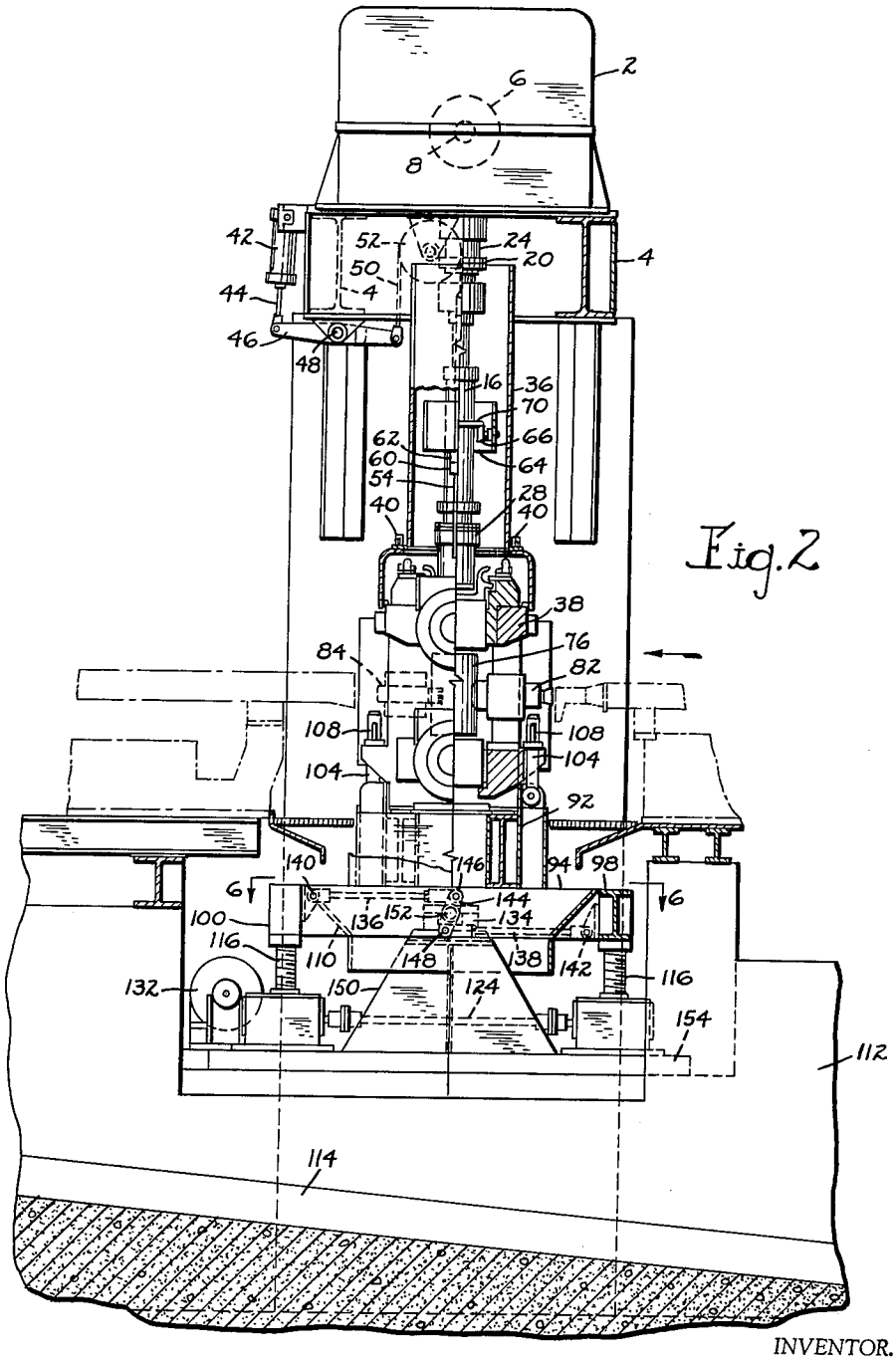

Fig. 2

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ROLLING MILL

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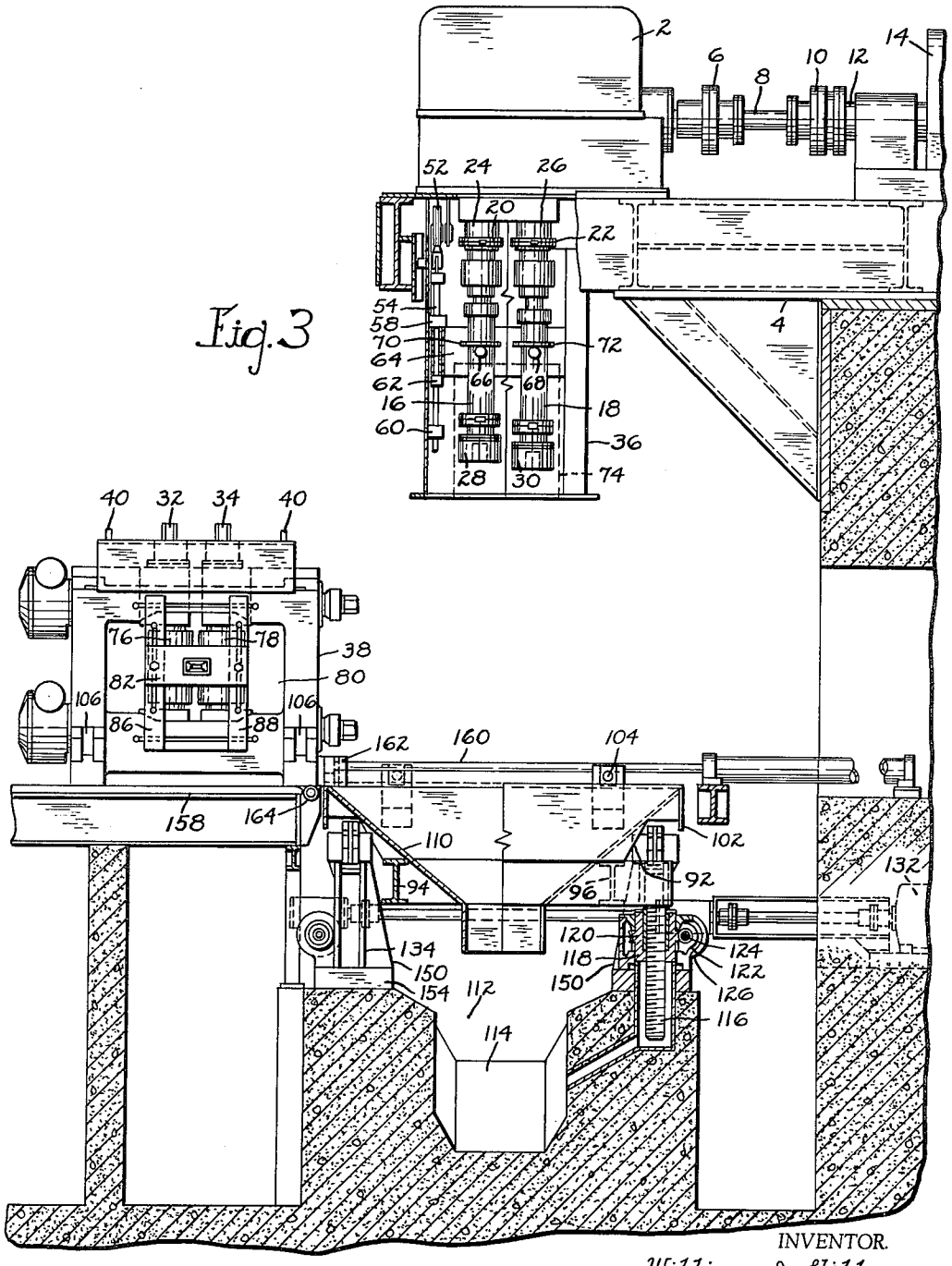
Fig. 3



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ROLLING MILL

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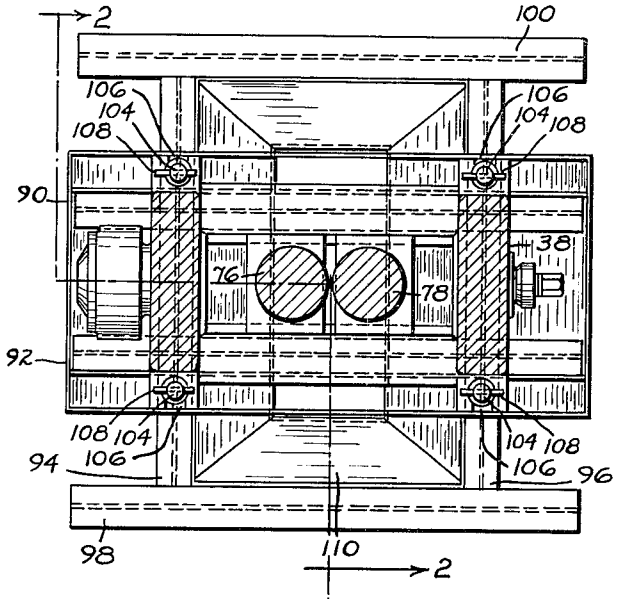

Fig. 4

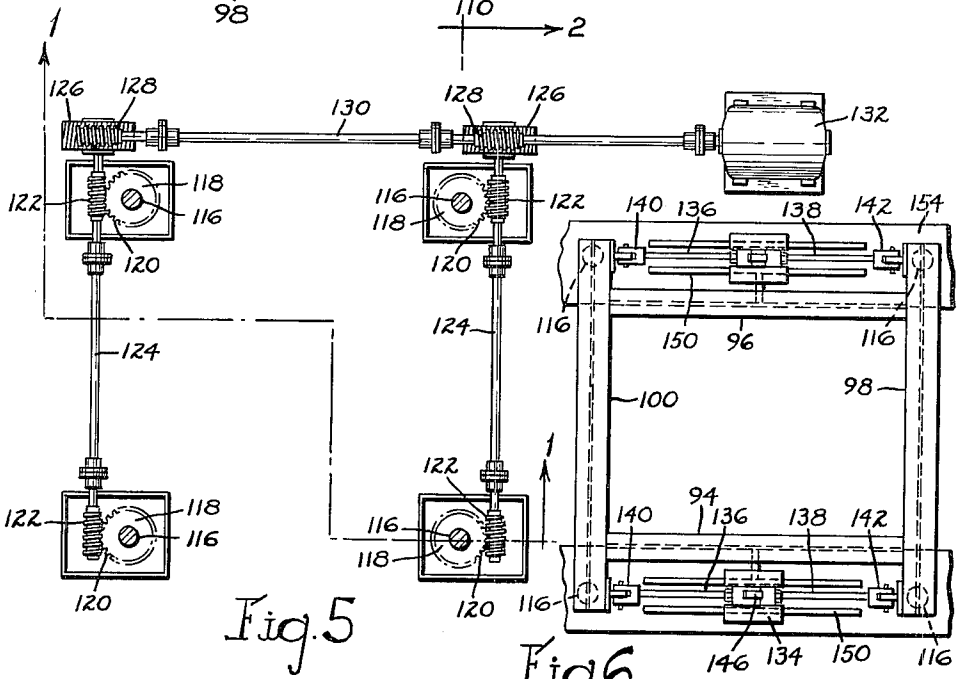

Fig. 5

Fig. 6

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3,222,901

ROLLING MILL

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11 Claims. (Cl. 72—39)

This invention relates to rolling mills and more particularly to vertical mill stands wherein the rolls may be easily removed.

In a continuous rolling mill, it is often desriable to provide in conjunction with the usual horizontal roll stands, one ro more roll stands with vertically disposed rolls. Where the vertical and horizontal roll stands are alternately set in tandem, the necessity of giving the stock a quarter turn between passes is avoided.

Due to the severe shocks suffered by the rolls as the stock is fed into them and the amount of pressure that must be exerted during the rolling process, rolls are subjected to considerable wear. Consequently, provisions for rapid and convenient roll adjustment and replacement must be made in order to maintain a uniform cross section of the roll passes.

Since the driving mechanisms of horizontal roll stands are laterally located with respect to the pass line, they provide no obstruction to overhead accessibility of the roll housing and thereby facilitate the replacement of horizontal rolls with a minimum loss of time.

In this respect, vertical roll stands have been the source of greater difficulty. As originally designed, the driving mechanisms were located beneath the roll housings, leaving the upper portion of the housings accessible to overhead cranes or other suitable means of removal. This method of installation contained numerous objectionable features. For example, the driving gears and spindles were exposed to cooling water applied to the rolls and to scale loosened from the stock as it passed through the mill, resulting in excessive wear. In addition, access to the driving mechanisms for purposes of inspection and repair was difficult, and the cost of excavation and construction of the foundations for such mill stands was comparatively high.

To avoid some of these difficulties, vertical mill stands were subsequently designed with the driving mechanisms located above the mill housing. Although the spindles, couplings and drives were no longer subjected to cooling water and scale, they now provided an obstruction to overhead accessibility of the rolls and provisions for moving the rolls to an alternate position where quick removal could be accomplished became necessary. To provide for this movement, the rolls and chocks were positioned within a roll housing which was in turn contained within a support frame. This roll housing was mounted on tracks and could be moved through a distance sufficient to clear the overhead driving mechanism. Although this arrangement did provide for overhead access to the rolls, elaborate mechanisms were required to move the roll housing vertically and horizontally within the support frame, resulting in considerable expense. In order to allow for horizontal movement to remove the inner roll housings, the support frames were necessarily designed with large windows, resulting in a corresponding loss of rigidity which in turn rendered this arrangement undesirable for heavy-duty vertical rolling mills. In addition, this necessitated excessive center to center distance between tandem roll stands to achieve the necessary horizontal clearances needed to permit removal of the frame by an overhead crane or other suitable means. Dismantling of the entering and delivery pass guides which extend a considerable distance on either side of the roll housing also became

necessary. Upon placing the new roll housing in position, excessive time was required to carefully re-set the pass guides in order to insure proper entrance and delivery of the stock.

By features disclosed herein many of the aforementioned difficulties can be avoided by providing a floor level base support mounted on vertically adjustable means and a free standing roll housing rigidly attached to but removably mounted on this base support.

Accordingly, the object of the present invention is to provide a vertical mill assembly in which the driving mechanism is advantageously mounted above a removably mounted roll housing arranged to facilitate replacement of rolls with a minimum loss of production time.

A specific object of this invention is to eliminate the necessity of a separate enveloping support frame for the roll housing, within which the rolls and chocks are positioned. This is accomplished by providing a more simple mounting which includes means for vertical adjustment and lateral displacement of the roll housing.

These and other objects of the invention will become more apparent as the description proceeds with the aid of the accompanying drawings in which:

FIG. 1 is a sectional view of a vertical roll stand embodying the principles of the invention taken along 1—1 of FIG. 5;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 4;

FIG. 3 is a sectional view of a roll stand similar to FIG. 1 showing the roll housing laterally displaced for removal or replacement;

FIG. 4 is a horizontal cross sectional view taken on line 4—4 of FIG. 1;

FIG. 5 is a horizontal cross sectional view taken on line 5—5 of FIG. 1; and

FIG. 6 is a horizontal cross sectional view taken on line 6—6 of FIG. 2.

Referring to the drawings, numeral 2 designates the casing which encloses the gearing for driving the rolls. Casing 2 is mounted on cantilever base 4 overlying the roll pass. The enclosed bevel gears (not shown) are coupled as at 6 to shaft 8 which is in turn coupled as at 10 with shaft 12 of the main driving motor 14.

Spindles 16 and 18 are of the extensible telescoping type and are suitably coupled as at 20 and 22 to shafts 24 and 26 which are driven through the gearing arrangement enclosed in casing 2. The lower portions of spindles 16 and 18 are comprised of coupling boxes 28 and 30 which are interiorly shaped to receive the mating wobblers 32 and 34.

To prevent any damage that might result should cobbles be created, the spindles 16 and 18 are enclosed within a shield 36 which is shown in place over the roll housing 38 in FIG. 1, and in its raised position in FIG. 3.

Prior to any lateral displacement of roll housing 38, spindles 16 and 18 are disconnected and raised sufficiently to clear wobblers 32 and 34, and shield 36 is raised through a distance sufficient to clear studs 40 which hold the shield 36 in place over housing 38 during the rolling operation.

The means used to accomplish this function will now be described: see FIGS. 1 and 2. Cylinder 42 is actuated and act through rod 44 to exert a clockwise force on bell crank 46 which is pivoted as at 48. Bell crank 46 in turn exerts a pull on cable 50 which passes over wheel 52 and is attached to rod 54 as at 56. Rod guide sleeves 58 and 60 are welded to shield 36. These support guide rod 54, allowing it to move vertically. Collar 62 is fixed to rod 54. Spindle carrier frame 64 rests on collar 62 and may be moved vertically within shield 36. Rollers 66 and 68 are suitably attached to spindle carrier frame 64 and are positioned to come sequentially into contact with

collars 70 and 72 on spindles 16 and 18 as the spindle carrier frame 64 is raised. As cable 50 is placed in tension, rod 54 is raised and acts through rod collar 62 to raise spindle carrier frame 64. Since spindle collar 70 is lower than spindle collar 72, spindle 16 is raised by rollers 66 before spindle 18 is raised by rollers 68. As rod 54 continues to move upward, spindle carrier frame 64 soon contacts rod guide sleeves 58 and exerts an upward force on shield 36, raising the shield through a distance sufficient to clear studs 40. As can be seen in FIG. 3, the original staggered arrangement of collars 70 and 72 results in spindle 16 being above spindle 18 when the spindles have been fully raised. Following the lateral displacement and removal of housing 38 and the installation of a reassembled or alternate roll housing, the spindles 16 and 18 and shield 36 are in position and ready to be lowered.

The staggered position of spindles 16 and 18 enables a man to reach through opening 74 in the rear of shield 36 and first position coupling 30 over wobbler 34. Connection can be made lowering frame 64. Then coupling 28 is positioned over wobbler 32 and the frame 64 is lowered further to complete the connection. The use of rollers 66 and 68 in contact with collars 70 and 72 allow the spindles to be rotated about their longitudinal axes, thereby facilitating the task of aligning the irregularly shaped wobblers 32 and 34 with the mating driving surfaces of the coupling boxes 28 and 30. Shield 36 is then secured to housing 38 by studs 40.

The rolls 76 and 78 are positioned in conventional manner within housing 38. Pass guides 82 and 84 may be mounted on housing 38 by means of rest bars 86 and 88.

When in operating position, the housing 38 rests on parallel box girder beams 90 and 92, (see FIG. 4) which are in turn fixed to a rectangular frame comprised of beams 94 and 96 located parallel to the pass line and beams 98 and 100 located transversely to the pass line. For convenience of description, the rectangular frame and beams 90 and 92 will be collectively referred to as an elevating platform 102. Housing 38 is secured to platform 102 by a plurality of pivoted studs 104 or otherwise as may be convenient. The pivoted studs 104 are received within recessed bifurcations 106 in housing 38 and locked in place by keys 108.

To deal effectively with the cooling water applied to the rolls and the scale loosened from the stock as it is passed through the mill, a trough 110 is integrally fabricated within platform 102. The water and scale is caught by trough 110 and discharged into flume 112 located within the mill foundation. As can be seen in FIG. 2, the floor 114 of the flume 112 is slanted to produce a flow in a direction aligned with the pass line. With this arrangement, the mechanism used to raise and lower platform 102 and which is about to be described is protected from exposure to cooling water and scale, thereby preventing excessive gear and bearing wear.

Platform 102 is supported at each corner by vertically disposed screw shafts 116 located under the ends of beams 98 and 100. Screw shafts 116 are fixed to beams 98 and 100 and do not rotate. As shown in FIG. 5, nuts 118, vertically immovable, are threaded upon shafts 116 and are provided peripherally with worm gear teeth 120. The worm gear teeth 120 are adapted to mesh with worms 122 carried by horizontal shafts 124. The horizontal shafts 124 are in turn equipped with worm gears 126 designed to mesh with worms 128 carried by shaft 130. It will be apparent from this description that when motor 132 is energized, shafts 124 will be simultaneously rotated, causing the vertically disposed screw shafts 116 to move up or down within nuts 118 to raise or lower platform 102 as desired.

To prevent any horizontal housing movement in the direction of the pass line as stock is passed through the rolls, the platform 102 is held in place by two "Watt Linkages" 134 located on either side of the pass line. See FIGS. 1, 2 and 6. Each of the "Watt Linkages" is comprised of arms 136 and 138 pivotally secured to beam 100 as at 140 and beam 98 at 142, and to member 144 as at 146 and 148. Member 144 is in turn pivotally secured to pedestal 150 as at 152. Pedestal 150 forms a part of base 154 which is secured to the main mill foundation 156.

The two "Watt Linkages," one on either side of the platform are particularly suited for this arrangement, since they effectively prevent any horizontal platform movement in the direction of the pass line, yet allow vertical adjustments to be made by the vertically disposed screw shafts 116.

The operation of the main embodiment of the invention will now be described. When the rolls 76 and 78 become sufficiently worn to require replacement, spindles 16 and 18 and shield 36 are disconnected from the housing 38 and raised according to the aforementioned procedure.

Platform 102 is then lowered to the level of tracks 158 by energizing motor 132 and causing the vertically disposed screw shafts 116 to operate. As shown in FIG. 3, the tracks 158 are located laterally of the pass line and preferably slightly below the mill floor. For safety purposes, when not in use the tracks 158 may be covered by steel plates or grating.

Keys 108 are then removed and the pivoted lugs 104 are withdrawn from the recessed bifurcations 106 located in housing 38. Piston 160 is then actuated and exerts a force on housing 38 at bracket 162. The housing 38 is pushed laterally from the pass line, passing over roller 164 and sliding along tracks 158.

It should be noted that since platform 102 can be elevated or lowered to any desired level, an alternate arrangement is possible whereby housing 38 could be laterally displaced to a movable platform and rolled aside in preparation for the lowering of a spare housing by an overhead crane onto a second set of tracks in line with beams 90 and 92.

As shown in FIG. 3, when fully displaced, the housing 38 is clear of the overhanging driving mechanisms and can be easily removed by an overhead crane or other suitable means. A spare housing containing new rolls and pass guides fully positioned and adjusted can then be lowered on tracks 158 and pulled back into position on platform 102 by piston 160. The housing 38 is then secured to beams 90 and 92 comprising the upper surface of platform 102 by pivoted studs 104 and keys 108, and raised to a position where the spindles 16 and 18 and shield 36 can be lowered and secured.

It is my intention to cover all changes and modifications of the example of the invention herein chosen for purposes of disclosure which do not constitute departures from the spirit and scope of the invention.

It is claimed:

1. Means for supporting a roll housing in a rolling mill, said means comprising a foundation having spaced portions, a plurality of vertically adjustable elevational means carried by said foundation, a platform mounted on said elevational means, a roll housing supported by said platform, link means connected intermediate said foundation and said platform for preventing movement of said platform in the direction of said pass line while allowing vertical adjustment of said platform, and an opening through said platform below said roll housing whereby cooling water flowing over said rolls may flow downward between the spaced portions of said foundation.

2. In a rolling mill, a vertically adjustable platform with tracks thereon, a roll housing with vertical rolls resting on said tracks and receiving sole support from said platform during the rolling operation, a plurality of simultaneously operating means for moving said platform up or down within limits, an alternate roll housing supporting area adjacent said platform, whereby when said tracks

have been horizontally aligned with said supporting area, said housing may be moved from one to the other.

3. Means for supporting a roll housing of a rolling mill in selected vertical position and for preventing movement in the direction of the pass line of the rolls, said means comprising a foundation, a plurality of vertically adjustable elements mounted on said foundation, a rigid frame including transverse and longitudinally extending beams resting on said elements, and two Watts Linkages mounted on the said foundation on either side of said frame, each linkage including two members extending longitudinally and connected to the frame, said linkages comprising means whereby said frame may be moved up or down by said adjustable elements but is prevented from moving longitudinally.

4. Means for supporting a roll housing of a rolling mill as set forth in claim 3, said foundation including a flume extending longitudinally below the center of said frame and means for directing used cooling water and roll scale through the center of said frame into said flume.

5. In a rolling mill, a foundation, a roll housing supporting platform, elevational means for adjusting said platform vertically, said platform providing the sole support for a roll housing containing vertical rolls, link means connected between said platform and said foundation for preventing movement of said platform and housing in the direction of the pass line, detachable overhead drive means for driving said rolls, a floor area adjacent said platform, and means for pushing said housing laterally from said platform on to said floor area when the platform and floor area have been vertically aligned and the drive means has been detached.

6. In a rolling mill, a roll housing, two vertical rolls in said housing, overhead drive means for said rolls, said drive means comprising a pair of drive shafts driven by a common power source, two couplings, each coupling slidable on its said drive shaft, and power operated means for automatically raising or lowering said couplings in staggered sequence to effect sequential disengagement or engagement of said rolls.

7. In a rolling mill, a pair of longitudinally extending spaced supporting walls, a bottom closing the space therebetween to form a flume, a platform extending across said flume, elevational means mounted on said walls for carrying and adjusting the vertical position of said platform, bracing means for preventing movement of said platform in a direction parallel to the pass line, said bracing means continuously operative during changes in the elevation of said platform, a roll housing removably mounted on said platform and receiving its sole support therefrom during the rolling operation, a pair of rolls in said housing, disconnectable overhead drive means for said rolls, and a floor immediately adjacent said platform whereby when said platform is elevated to the same level as said floor, said roll housing may be disconnected and laterally displaced therefrom to a position on said floor vertically clear of said overhead drive means.

8. In a rolling mill, a roll housing, a pair of cooperating rolls mounted therein and defining a pass line therebetween, a vertically adjustable platform providing the sole support during rolling for said roll housing, means for raising and lowering said platform thereby adjusting the vertical position of said roll housing, means for removing the roll housing from the platform in a direction transversely of the pass line, and means for driving said rolls.

9. In a rolling mill, a roll housing, a pair of rolls carried by said roll housing, a platform providing the sole support for said roll housing during the rolling operation, means for vertically adjusting said platform thereby adjusting the vertical position of said rolls, and disconnectable means for driving said rolls.

10. In a rolling mill, a pair of vertical rolls in a roll housing, overhead disconnectable means for driving said rolls, a vertically adjustable platform providing the sole support for said housing during the rolling operation, an opening through said platform below said roll housing whereby cooling water applied to said rolls and rolling scale may drain downwardly therethrough, and a flume below said opening paralleling the pass line of said rolls.

11. In a rolling mill, a pair of longitudinally extending spaced supporting walls, a bottom closing the space therebetween to form a flume, a platform extending across said flume, means mounted on said walls for carrying and adjusting the vertical position of said platform, a roll housing removbly mounted on said platform and receiving its sole support therefrom during the rolling operation, a pair of rolls in said roll housing, disconnectable overhead drive means for said rolls, a floor immediately adjacent said platform whereby when said floor and platform are on the same level, said roll housing may be laterally displaced at right angles to the pass line to a position on said floor vertically clear of said overhead drive means, and means for laterally displacing said roll housing on said floor.

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