April 9, 1968 R. A. WOLFENDALE ETAL 3,376,724

AUTOMATIC ROLL CHANGING MEANS AND METHODS OF ROLL CHANGING

Filed April 5, 1966 3 Sheets-Sheet 1

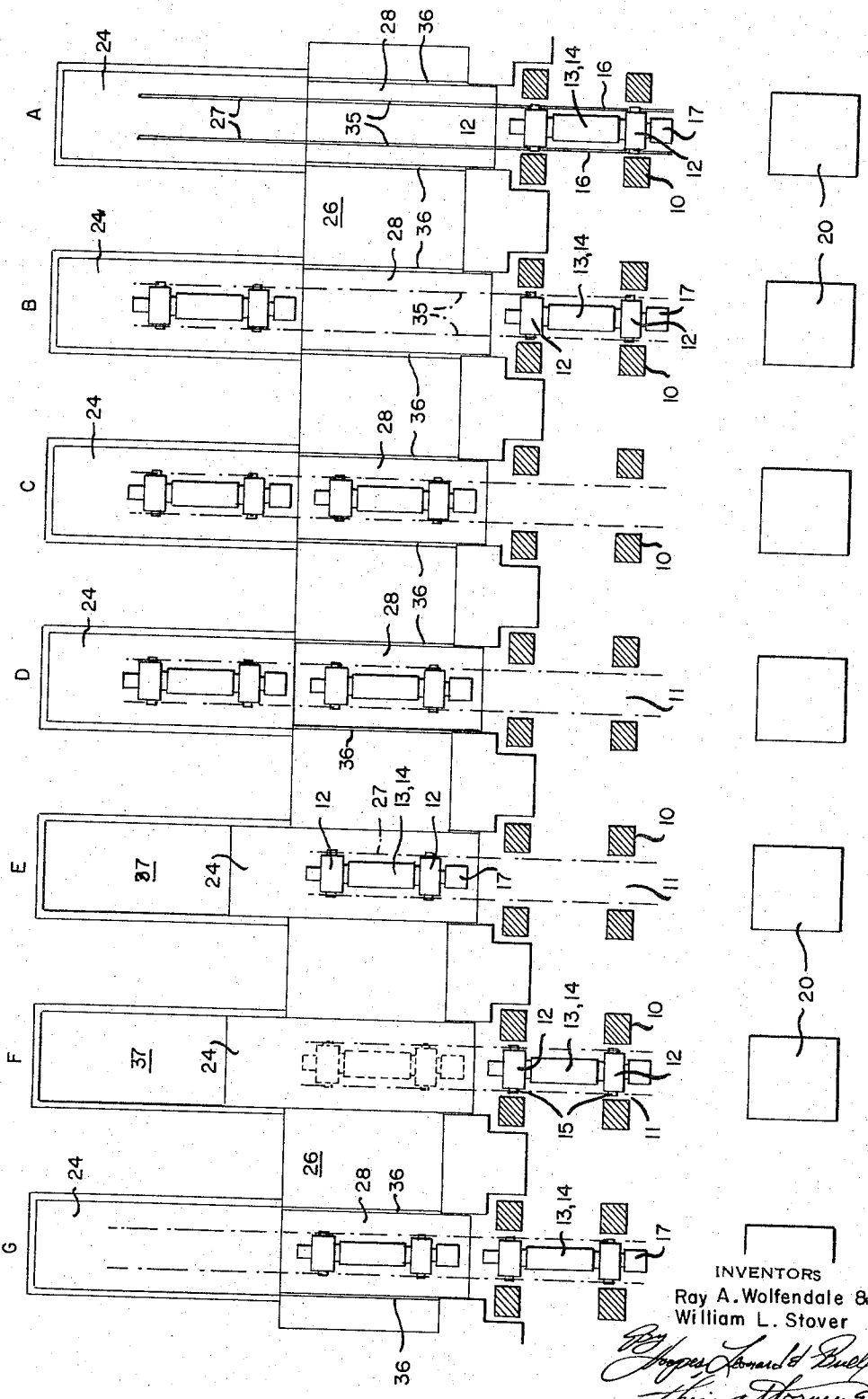


Fig. 1.

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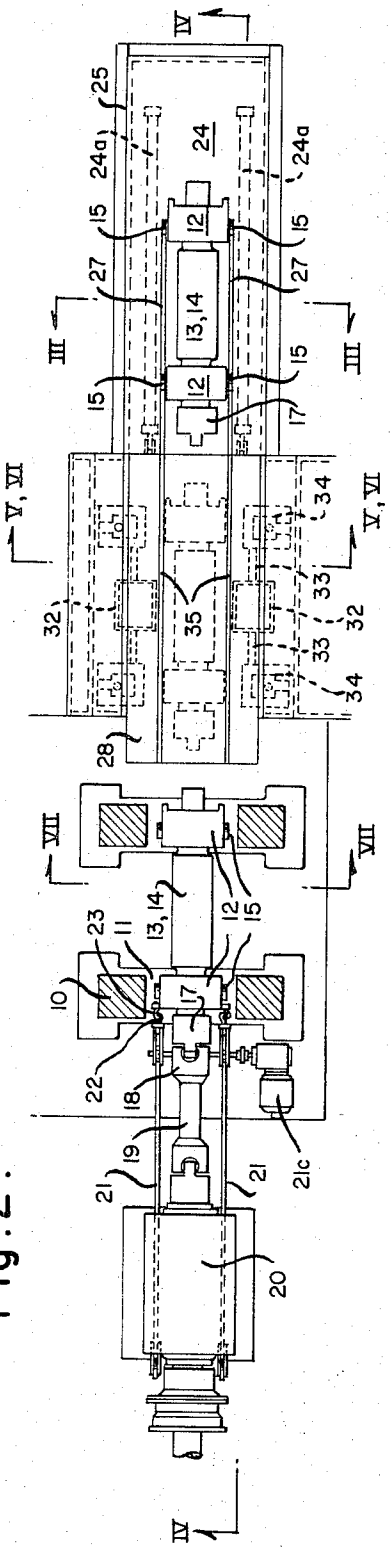


Fig. 2.

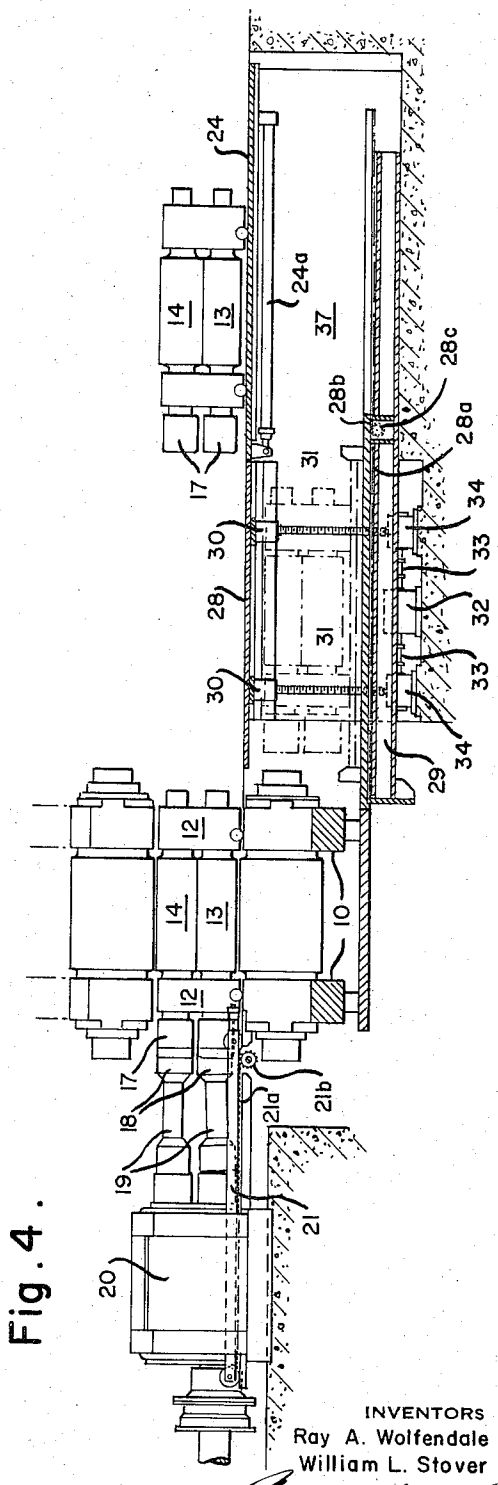


Fig. 4.

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Fig.3.

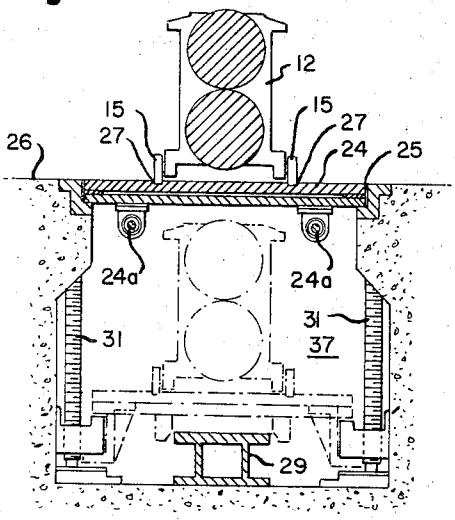


Fig.5.

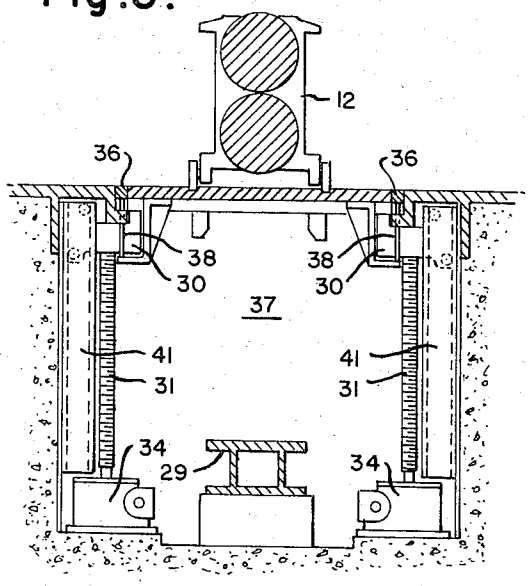


Fig.7.

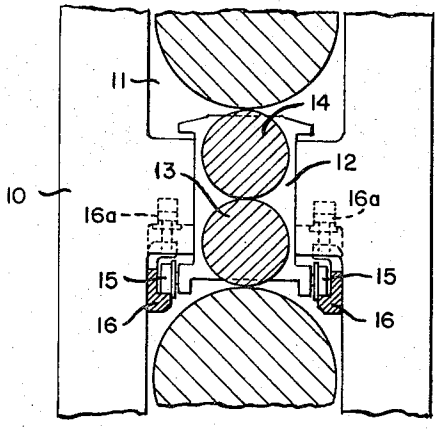
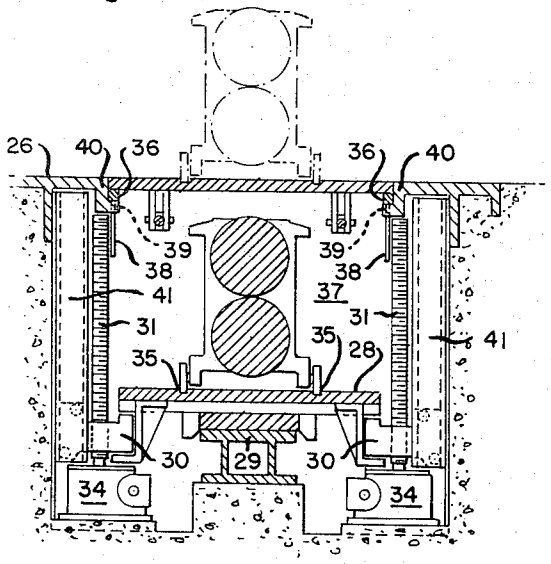


Fig.6.



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3,376,724

AUTOMATIC ROLL CHANGING MEANS AND METHODS OF ROLL CHANGING

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6 claims. (Cl. 72—239)

This invention relates to automatic roll changing means and methods of roll changing and particularly to an automatic roll changing means in which the work rolls are moved endwise from the mill housings to an elevating means which lowers them below the floor line while new rolls are moved thereover and into the mill or vice versa.

In the past it has been conventional practice to change one roll of a rolling mill at a time using a hollow sleeve and counterweight together with an overhead crane. This practice is much too slow and costly. In order to overcome this problem various solutions have been proposed, giving some advantages but still having many disadvantages. One of the more recent means for removing rolls has been a turntable arrangement in which work rolls to be inserted into a mill are placed on one half of a turntable and the rolls to be removed are pulled onto the other half, the table rotated and the new rolls inserted. This arrangement has the disadvantage that the two sets of rolls are close to the mill, blocking vision thus obstructing the area around the mill. In addition, the whole table arrangement must be removed in order to charge back-up rolls. This is a time consuming operation and requires heavy handling equipment.

The method and apparatus of our invention eliminates all manual operations and the use of an overhead crane during the roll changing operation. The practice of our invention frees the area of obstruction both before and after roll changing and positions the removed rolls so that they may be taken from the mill area at leisure after the pressing operation of roll changing has been accomplished. This significantly reduces the lost time during roll changes and reduces the hazards which accompany conventional roll changing technique.

In a preferred embodiment of our invention, we provide a rolling mill stand interchangeably receiving a pair of work rolls, paired work rolls operatively mounted on carrier means adapted to be moved into and out of said rolling mill stand, drive means on one side of said rolling mill stand operatively engaging said work rolls when said rolls are in the mill stand, pusher means on the said one side of said mill stand for moving said work roll carrier means into and out of said stand, a sliding floor member movable from a first position adjacent the other side of said mill stand selectively receiving and discharging said carrier means and rolls into and out of the mill stand to a second position remote from the mill stand, a well on said other side of the mill stand, elevator means in said well, a vertically movable elevating floor member on said elevator movable from said first position of the sliding floor plate when said sliding floor plate is in its remote position to a bottom position at the base of the well, said vertically movable floor plate selectively receiving and discharging a work roll carrier means and rolls into the mill stand in said first position and carrying said work roll carrier means beneath the floor level, and drive means for moving said sliding floor member selectively relatively to the movement of the elevating means. Where the mill stand is provided with back-up rolls, means are preferably provided for moving the elevating floor member and work roll carrier and rolls at the bottom of the well lengthwise from the elevator means beneath the remote position of the sliding floor plate. Preferably the

elevating and sliding floor members are provided with spaced generally parallel trackways receiving the work roll carrier means provided with wheels guided by said trackways.

In the foregoing general description, we have set out certain objects, purposes and advantages of our invention. Other objects, purposes and advantages of our invention will, however, be apparent from a consideration of the following description and the accompanying drawings in which

FIGURE 1 is a top plan view of a series of successive roll stands partly in section in a rolling mill line embodying our invention;

FIGURE 2 is an enlarged top plan view of one mill stand of FIGURE 1;

FIGURE 3 is a section on the line III—III of FIGURE 2;

FIGURE 4 is a section on the line IV—IV of FIGURE 2;

FIGURE 5 is a section on the line V—V of FIGURE 2 with the elevating floor plate in raised position;

FIGURE 6 is a section on the line VI—VI of FIGURE 2 with the elevating floor plate in lowered position and the moving floor plate covering the well; and

FIGURE 7 is an enlarged section on the line VII—VII of FIGURE 2.

Referring to the drawings, we have illustrated rolling mill end housings **10** having windows **11** through which roll carrier members **12** carrying work rolls **13** and **14** move up wheels **15** which in turn are supported on rails **16** suspended on hydraulic pistons **16***a* in housings **10**. Each roll is provided with coupling halves **17** engaging coupling halves **18** on drive spindles **19** extending from gear boxes **20** on one side of mill housings **10**. A pusher member **21** is provided beneath gear boxes **20** and drive shafts **19** carrying automatic coupler members **22** adapted to engage couplers **23** on carrier member **12**. The pusher is provided with rack **21***a* driven by pinion **21***b* from motor **21***c*. A sliding floor plate **24** is provided in a recess **25** in the main floor **26** on the side of the mill housing opposite the gear boxes **20**. The top surface of sliding floor plate **24** is provided with spaced, generally parallel grooves **27** in the upper surface which grooves match rails **16** and carry wheels **15**. The sliding floor plate **24** is moved between a position adjacent mill housings **10** to a position remote from the mill housings (FIGURE 4) by piston **24***a*. An elevating floor plate **28** is slidable on ways **29** which form a back-up roll changing sled extension beneath the main mill floor **26** from a position adjacent the mill housings **10** to a position remote therefrom. The floor plate **28** is moved by rack **28***a* on the bottom thereof by means of pinion **28***b* on shaft **28***c* driven by any conventional means. In the position adjacent mill housings **10**, the elevating floor member **28** rests on lift arms **30** threaded on screws **31** forming the corners of a quadrangle outlining the elevating floor member. The screws **31** are rotated simultaneously from drive motors **32** through shafts **33** and worm and pinion gears contained in gear boxes **34**. The elevating floor member or plate **28** is provided with grooves **35** identical with grooves **27** of the sliding floor plate. Filler plates **36** are provided at each side of well **37**, containing the screws **31** and elevating floor plate **28**. Each filler plate **36** is provided with guide pins **38** extending through openings **39** in the floor side frames **40** so that when the elevating floor plate is raised the pins are engaged by the elevating floor plate extension **43** and raised to the position shown in FIGURE 6 to fill the gap between the floor side frames **40** and elevating floor plate **28**. When the elevating floor plate is lowered the filler plates drop to the position shown in FIGURE 6 where they act as sup-

port rails for the sliding floor plate **24**. Each lift arm **30** is guided by guide frames **41** adjacent each screw **31**.

The operation of this invention is sequentially illustrated in FIGURE 1 and is as follows. The normal operation condition of the mill is shown in Stand A of FIGURE 1 with work rolls in place in mill housings **10**. When it is desired to change work rolls, the replacement work rolls **13** and **14** are loaded with work roll carriers **12** on the sliding floor plate **24** in its remote position as shown in Stand B of FIGURE 1. In this position the elevating floor plate **28** is in the elevated position flush with the main floor **26** with filler plates **36** in the raised position. With the replacement rolls in position, the drive motor for the use rolls is stopped and the top work roll balance in the mill stands released. The rails **16** are raised by hydraulic pistons **16***a*. The pusher member coupler members **22** are engaged with couplers **23** on the carrier member in the mill housing. The pusher members are then moved by rack and pinion drive **21**, **21***a*, **21***b*, and **21***c* to push the carrier member out of the mill housing from rails **16** to grooves **35** on the elevating floor plate **28** to the position shown in Stand C of FIGURE 1 and by FIGURE 5. The screws **31** are actuated to lower the elevating floor plate **28** to the bottom of the elevator well as shown in Stand D of FIGURE 1. The sliding floor plate is moved into position over the well by piston **24***a* as shown by Stand E of FIGURE 1 and by FIGURE 6. The pusher couplers **22** are engaged in couplers **23** of the work roll carrier member carrying the new replacement rolls and the carrier member and rolls are drawn by the pusher into position in the mill stand as shown in Stand F of FIGURE 1 and the mill is started. The sliding floor plate is then withdrawn to its remote position and the elevating floor plate raised by screws **31** to its uppermost position flush with the main floor. This brings the removed used rolls up to floor level where they may be removed as desired without any interfering with mill operations (see Stand G of FIGURE 1).

The above described procedure could be reversed with equally satisfactory results. In other words, the new rolls could be placed on the elevating floor plate and lowered into the well or pit after which the sliding floor plate would be moved over the well, the used rolls moved onto it, the sliding plate withdrawn, the elevating floor plate and replacement rolls raised and the replacement rolls drawn into position in the mill stand.

In cases where back-up rolls are to be removed at the same time the work rolls are replaced, the used rolls are removed onto the elevating floor plate, and the floor plate is lowered to the position shown in chain line in FIGURE 4. The elevating floor plate is then moved away from the mill stand to a position beneath the remote position of the sliding floor plate. When the back-up rolls have been replaced, the elevating floor plate is returned to the elevating screws **31** and the balance of the changing cycle carried out. In the event that only back-up rolls are to be changed the work rolls may be removed onto the sliding floor plate, the sliding floor plate withdrawn to its remote position, the elevating floor plate lowered onto the lower back-up roll changing sled extension and the back-up rolls changed in usual manner. After the new back-up rolls are in place, the work rolls are returned to the mill stand as previously described.

While we have illustrated and described a present preferred embodiment of our invention in the foregoing specification, it will be understood by men skilled in the art that this invention may be otherwise embodied within the scope of the following claims.

We claim:

1. A rolling mill with automatic work roll changing comprising a rolling mill stand interchangeably receiving paired work rolls, paired work rolls operatively mounted on carrier means adapted to be moved into and out of said rolling mill stand, drive means on one side of said rolling mill stand operatively engaging said work rolls when said rolls are in the mill stand, pusher means on the said one side of said mill stand for moving said work roll carrier means into and out of said stand, a sliding floor member movable from a first position adjacent the other side of said mill stand selectively receiving and discharging said carrier means and rolls into and out of the mill stand to a second position remote from the mill stand, a well on said other side of the mill stand, elevator means in said well, a vertically movable elevating floor member on said elevator means movable from said first position of the sliding floor member when said sliding floor member is in its remote position to a bottom position at the base of the well, said vertically movable floor plate selectively receiving and discharging a work roll carrier means and rolls into the mill stand in said first position and carrying said work roll carrier means and work rolls beneath the floor level and drive means for moving said sliding floor member selectively relatively to the movement of the elevating means.

2. A rolling mill with automatic work roll changing comprising a rolling mill stand, work roll carrier means movable on ways in said mill stand interchangeably receiving paired work rolls, paired work rolls operatively mounted on said carrier means, drive means on one side of said rolling mill stand operatively engaging said work rolls when said rolls are in the mill stand, pusher means on the said one side of said mill stand for moving said work roll carrier means into and out of said stand, a sliding floor member having ways mating with the ways on the mill stand and movable from a first position adjacent the other side of said mill stand selectively receiving and discharging said carrier means and rolls into and out of the mill stand on said ways to a second position remote from the mill stand, a well on said other side of the mill stand, elevator means in said well, a vertically movable elevating floor member on said elevator means having ways mating with the ways on said mill stand movable from said first position of the sliding floor member when said sliding floor member is in its remote position to a bottom position at the base of the well, said vertically movable floor plate selectively receiving and discharging a work roll carrier means and rolls on said ways into the mill stand in said first position and carrying said work roll carrier means and work rolls beneath the floor level and drive means for moving said sliding floor member selectively relatively to the movement of the elevating means.

3. A rolling mill as claimed in claim **2** wherein said carrier means is provided with wheels rolling on the ways in said mill stand and floor member.

4. A rolling mill with automatic work roll changing comprising a rolling mill stand having spaced housings on opposite sides of a mill center line, windows in said housings, ways extending through said housings transverse to the center line, carrier means movable on said ways into and out of said housings and interchangeably receiving paired work rolls, paired work rolls operatively mounted on carrier means adapted to be moved into and out of said rolling mill stand with said carrier means, drive means on one side of said rolling mill stand operatively engaging said work rolls when said rolls are in the mill stand, pusher means on the said one side of said mill stand selectively engaging said carrier means for moving said work roll carrier means into and out of said stand, a sliding floor member movable from a first position adjacent the other side of said mill stand selectively receiving and discharging said carrier means and rolls into and out of the mill stand to a second position remote from the mill stand, a well on said other side of the mill stand, elevator means in said well, a vertically movable elevating floor member on said elevator means movable from said first position of the sliding floor member when said sliding floor member is in its remote position to a bottom position at the base of the well, said vertically movable floor plate selectively receiv-

ing and discharging a work roll carrier means and rolls into the mill stand in said first position and carrying said work roll carrier means and work rolls beneath the floor level and drive means for moving said sliding floor member selectively relatively to the movement of the elevating means.

5. A rolling mill structure as claimed in claim 4 having filler means on each side of said well, said filler means supporting the sliding floor member in its said first position and rising with the elevating floor member to provide a flush service when said elevating floor member is in said first position.

6. A rolling mill with automatic work roll changing comprising a rolling mill stand interchangeably receiving paired work rolls, paired work rolls operatively mounted on carrier means adapted to be moved into and out of said rolling mill stand, drive means on one side of said rolling mill stand operatively engaging said work rolls when said rolls are in the mill stand, pusher means on the said one side of said mill stand for moving said work roll carrier means into and out of said stand, a sliding floor member movable from a first position adjacent the other side of said mill stand selectively receiving and discharging said carrier means and rolls into and out of the mill stand to a second position remote from the mill stand, drive means moving said sliding floor member between said first and second positions, a well on said other side of the mill stand, elevator means in said well, a vertically movable elevating floor member on said elevator means movable from said first position of the sliding floor member when said sliding floor member is in its remote position to a bottom position at the base of the well, said vertically movable floor plate selectively receiving and discharging a work roll carrier means and rolls into the mill stand in said first position and carrying said work roll carrier means and work rolls to a second position beneath the floor level, ways in said well receiving the vertically movable floor plate in its second position, and drive means for moving said vertically movable floor member selectively on said ways from the elevating means to a position remote from the mill stand.

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