June 21, 1966 H. J. KALBERKAMP 3,256,728

ROLLING MILLS

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Fig. 1.

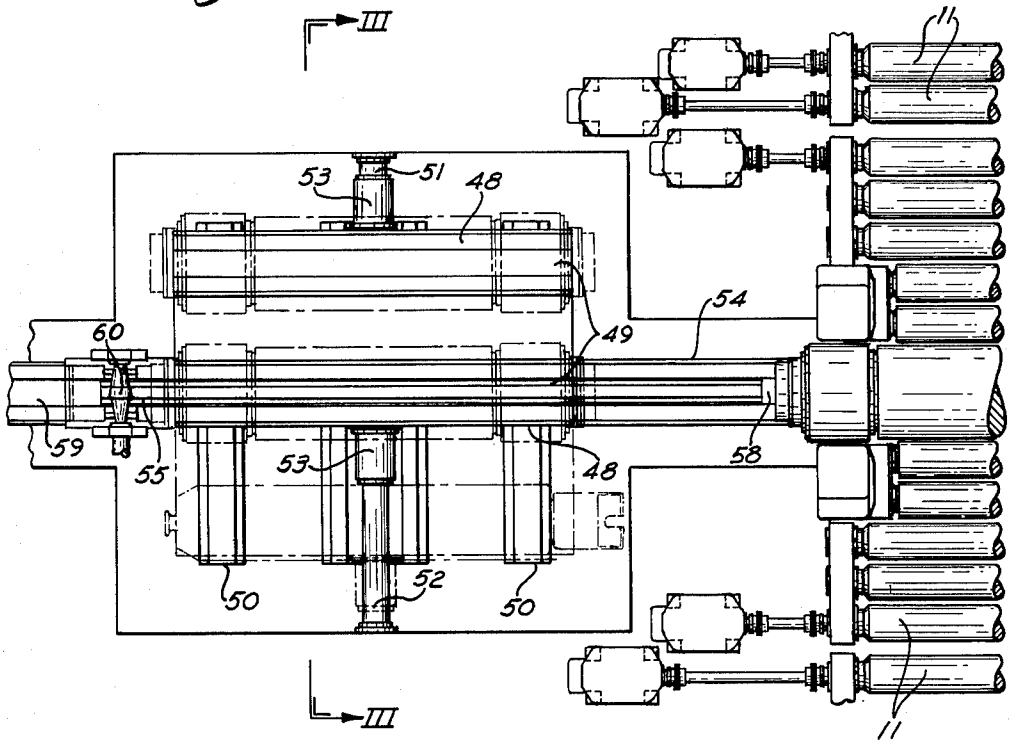
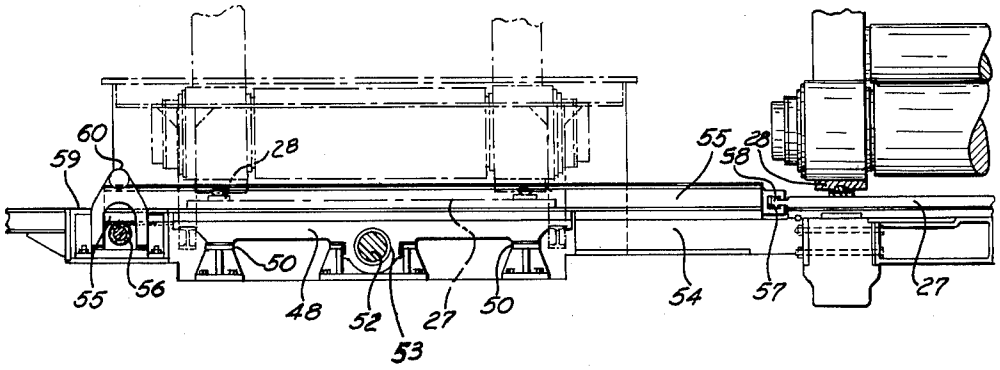


Fig. 2.



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Fig. 7.

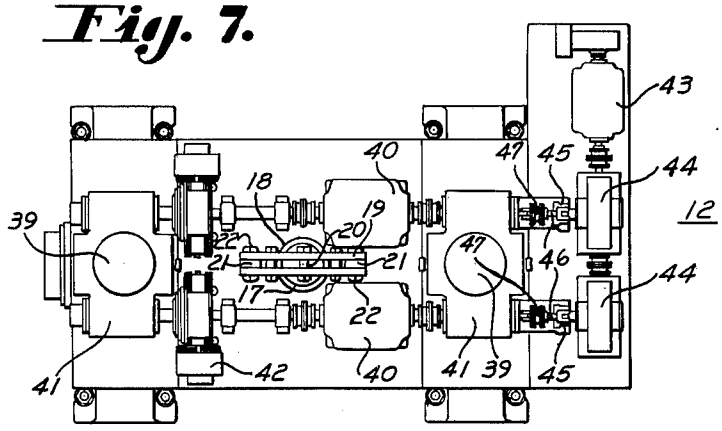
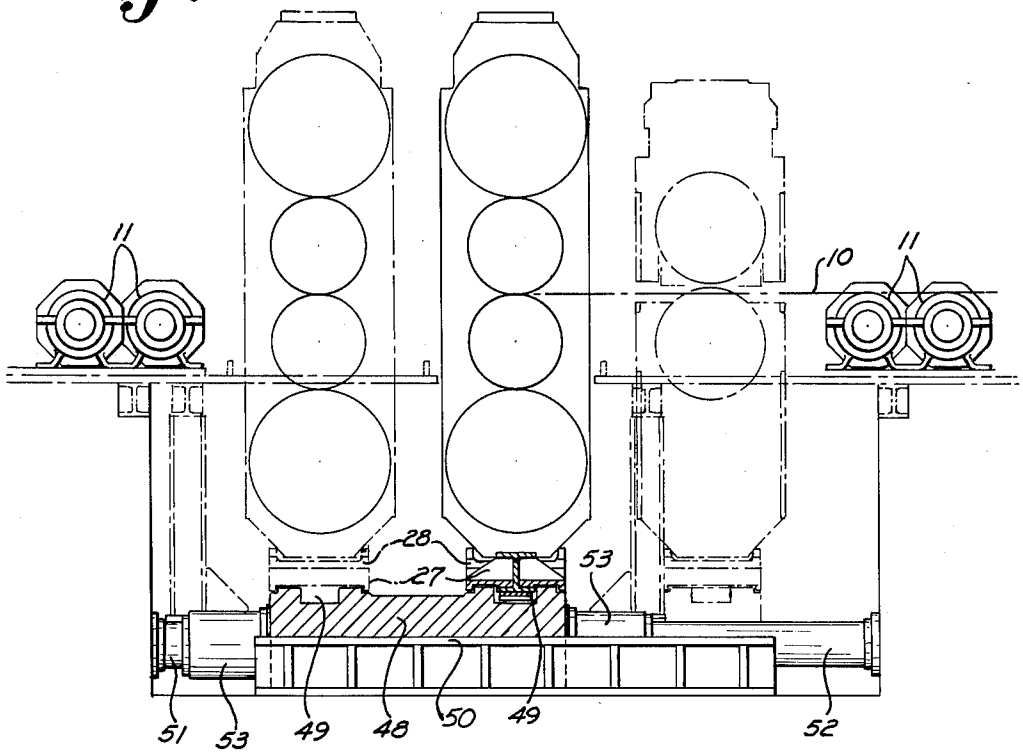


Fig. 3.



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ROLLING MILLS

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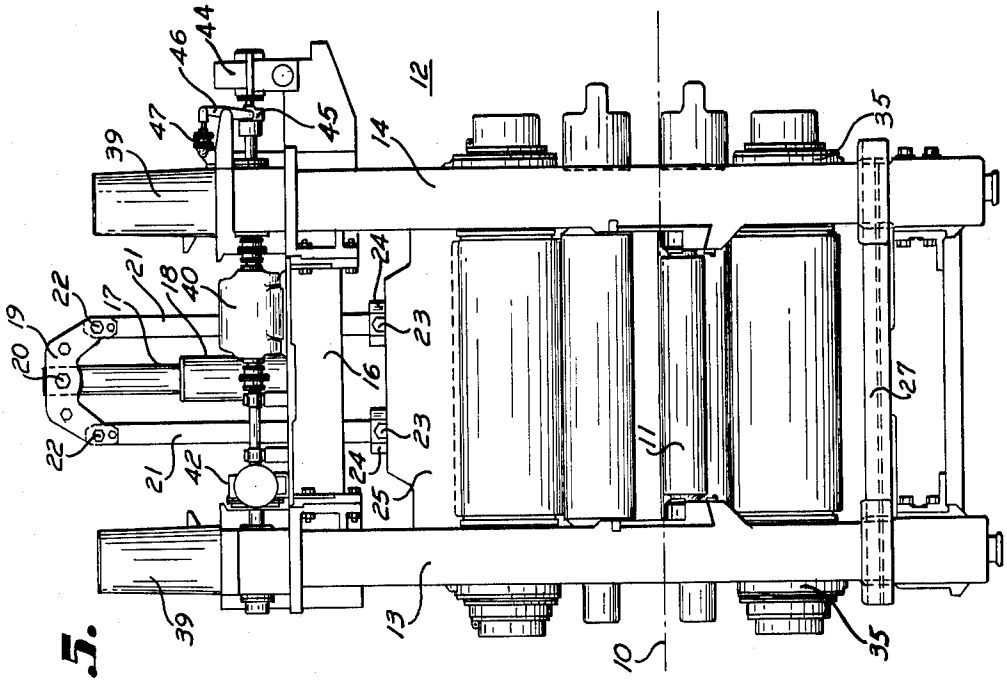


Fig. 5.

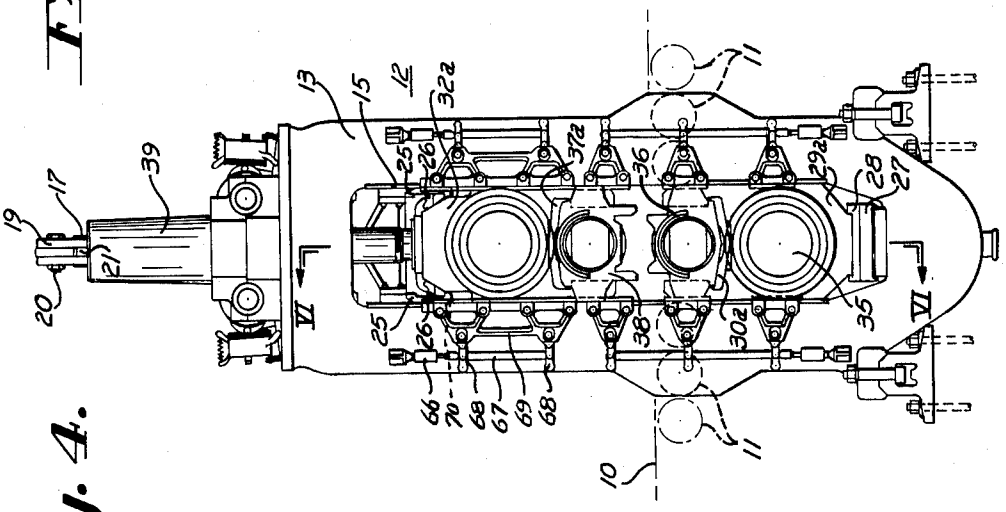


Fig. 4.

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June 21, 1966 H. J. KALBERKAMP 3,256,728

ROLLING MILLS

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Fig. 6.

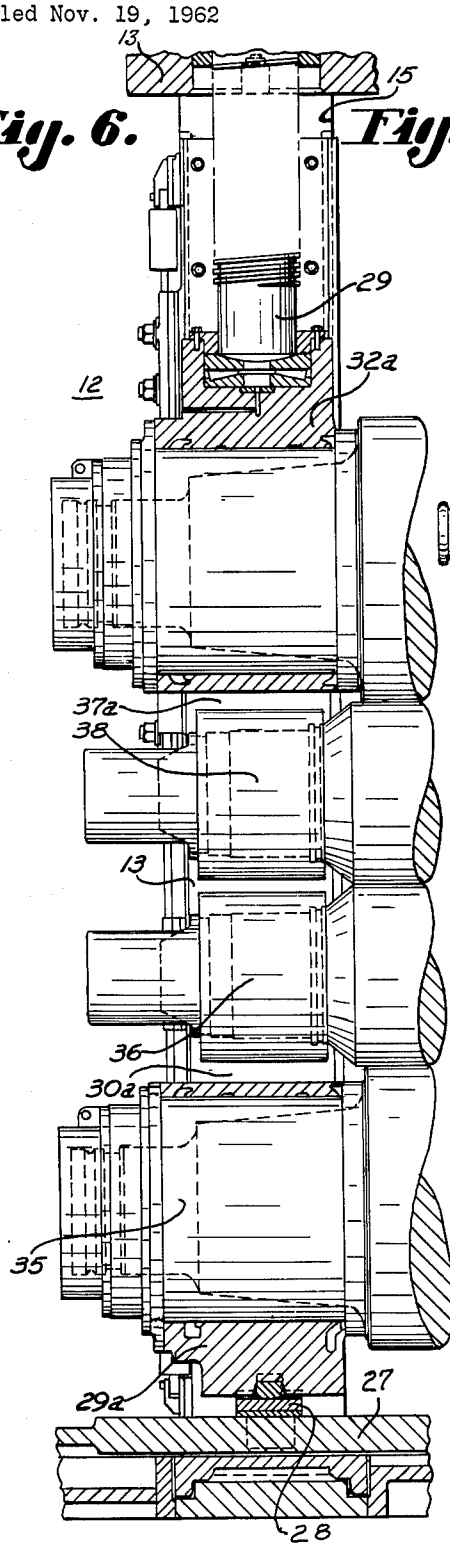
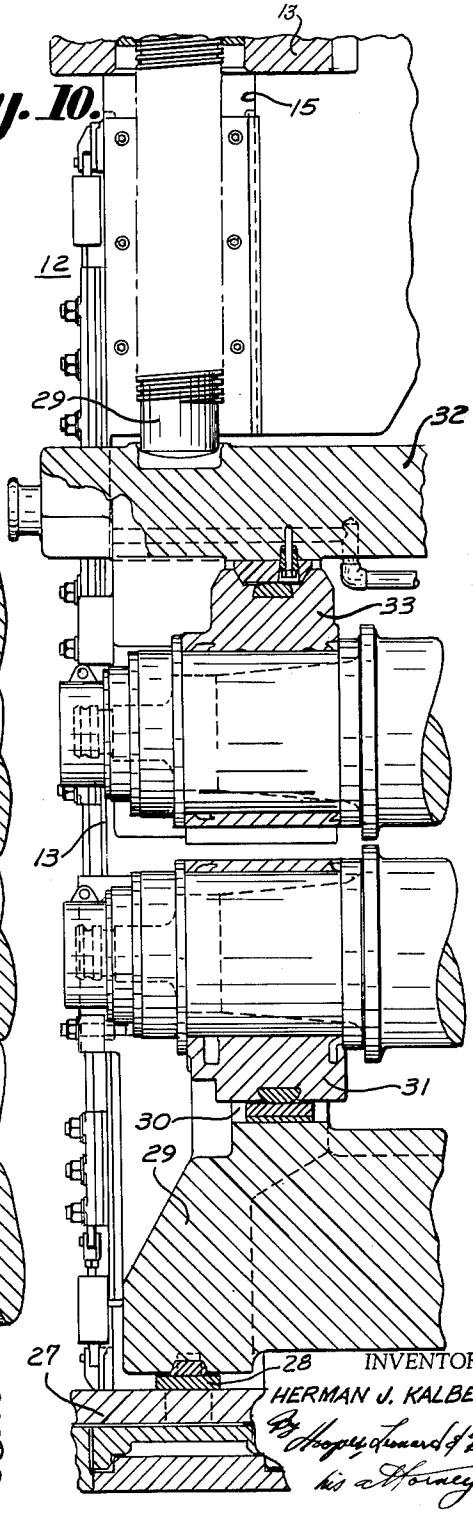


Fig. 10.



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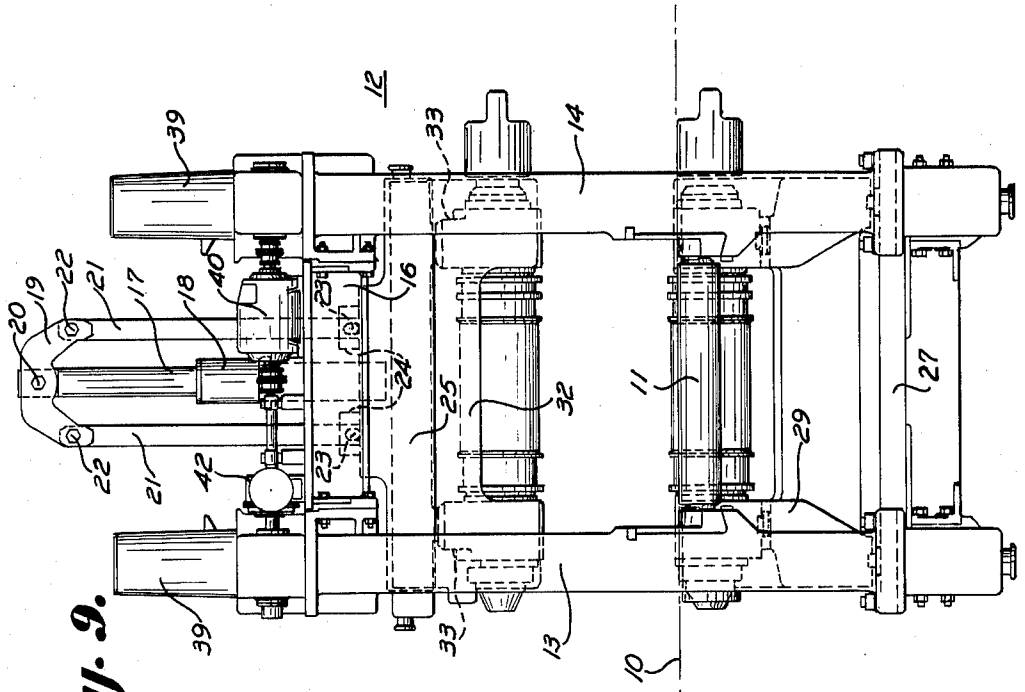


Fig. 9.

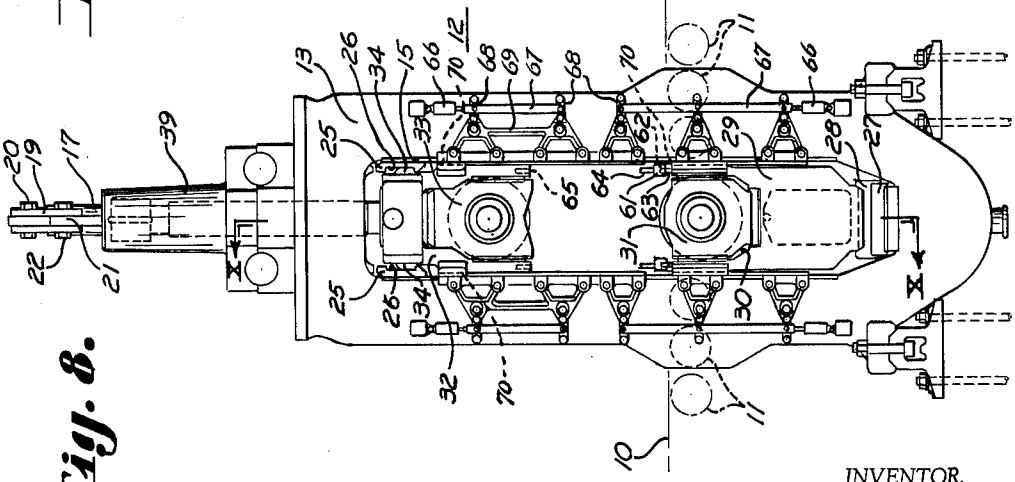


Fig. 8.

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3,256,728

ROLLING MILLS

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Filed Nov. 19, 1962, Ser. No. 238,406
8 Claims. (Cl. 72—238)

This invention relates to rolling mills and particularly to convertible rolling mills in which a single mill stand may selectively be four-high or two-high and of different widths at the option of the operator.

Rolling mills have, in the past, been so constructed that they were of a single width and of limited utility or the housings were movable requiring extensive alteration of the mill in order to change its width. For example, a slabbing and blooming mill has been conventionally a two-high mill of a given width incapable of use for any other purpose or at most very limited additional purposes. Similarly four-high plate or strip mills had a single width and had no utility as a slabbing mill with different width of rolls. As a consequence separate pass lines and separate mill stands were required for each different width of mill. This required large amounts of floor space, an additional set of run out tables, power sources and mill stands, many of which might be used only a fraction of the time.

I have invented a rolling mill structure which makes it possible to use a single pass line and a single mill stand to roll with different width of rolls for a variety of products of different widths on either two or four high mills. I preferably provide a rolling mill stand having spaced housings on opposite sides of a rolling mill pass line, windows in said housings adapted to removably receive vertically aligned rolls, a plurality of sets of vertically aligned rolls each mounted in upper and lower beams on transport means adapted to be interchangeably inserted in said windows with their axis transverse to the pass line, means for selectively moving said sets of rolls parallel to and spaced from said pass line into alignment with said windows and means acting on said transport means to move the aligned set of rolls selectively into and out of the housing windows and locking means on the housing releasably holding the set of rolls in said windows. Preferably the vertically aligned rolls rest in chocks carried in the upper and lower beams and bearing on one another in vertical alignment and carried on a sliding sled moved by a rack and pinion. The mill stand is preferably provided with variable speed drives for the screw downs so that they can be operated at high or low speed depending upon the nature of the stand.

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

FIGURE 1 is a top plan view partly broken away of a rolling mill according to my invention;

FIGURE 2 is a side elevation of the rolling mill structure of FIGURE 1;

FIGURE 3 is a section partly schematic on the line III—III of FIGURE 1;

FIGURE 4 is an end elevation of a mill stand for use in my invention carrying a four-high roll arrangement;

FIGURE 5 is a side elevation of the mill stand of FIGURE 4;

FIGURE 6 is a section on the line VI—VI of FIGURE 4;

FIGURE 7 is a top plan view of the mill stand of FIGURE 4;

FIGURE 8 is an end elevation of the mill stand of FIGURE 4 carrying a two-high mill arrangement;

FIGURE 9 is a side elevation of the mill of FIGURE 8; and

FIGURE 10 is a section on the line X—X of FIGURE 8.

Referring to the drawings, I have illustrated a mill pass line **10** having table rollers **11** on each side of a mill stand **12**. The mill stand **12** is provided with end housings **13** and **14** on opposite sides of the pass line. Each housing **13** and **14** is provided with a vertically aligned window **15** adapted to receive the chocks of rolls to be more fully described hereafter. The head **16** of the mill stand is provided with a piston **17** vertically movable out of cylinder **18** by hydraulic pressure. The piston **17** carries a crosshead **19** pivoted on a pin **20** on the end of the piston. Each end of the crosshead **19** carries a depending link **21**, pivoted at one end on a crosspin **22** on the end of the crosshead and pivotally mounted at the other end on a crosspin **23** in spaced clevises **24** carrying transverse beam carrier **25** extending through the windows **15** on each housing. The beam carrier **25** extends through the housings parallel to the axis of the rolls. The beam carrier is provided with a channel **26** on each side facing inwardly and spaced apart from one another.

Each set of rolls is mounted on a sled **27** and is spaced vertically upward from the sled by a pad or pads **28** of selected thickness. Each set of rolls is made up of a bottom roll carrying beam **29** which is provided with a recess **30** carrying the bottom roll chock **31**. An upper beam **32** carries the top roll chock **33**. In the case of a two-high mill this makes up the roll set. The upper beam in each case is provided with ears **34** on each side which engage the channels **26** in the beam carrier **25**. A typical two-high installation is illustrated in FIGURES 7 and 8. In the case of a four-high mill such as illustrated in FIGURES 4 and 5, the lower backup roll bearings **35** are mounted in the bottom beam **29***a* and the beam is provided with a recess **30***a* carrying the work roll chocks **36**. Similarly, the upper work roll is mounted in the upper beam **32***a* and an upper recess **37***a* carries the work roll chocks **38**. Again the upper beam **32***a* is provided with outwardly extending ears adapted to slidably engage the channels **26** in the beam carrier **25**.

The housings are provided with screw downs **39** which act on the upper beam **32**. Where the rolls are of the same width as the housing centers, as is the case of the four-high mill illustrated in FIGURES 4–6, the center line of the screw downs **39** is the center line of the chocks and bearings **35** and **38** and the force of the screw down acts on a straight line through the chocks. This is the conventional screw down line of force. In the case where the rolls are of lesser width than the mill housing centers, the center line of the screw downs is offset from the center line of the bearings. Such a condition is illustrated in the two-high mill of FIGURES 8–10. In this case the force of the screw downs is applied to the roll beam **32** carrying the upper roll chocks and the lower beam **29** carrying the lower roll chocks, and is transmitted on an offset line to the roll chocks. This is illustrated in FIGURE 10. In short, the roll carrying beams **29** and **32** form the intermediate housing for the chocks and transmit the screw down force to a line parallel to the center line of the screw downs, this permitting any arrangement of widths narrower than the housing centers without changing the position of the housings or requiring a complete set of fixed housings of different width. The screw downs are of conventional form. The drive system for the screw downs is unique. Two drive systems are provided. In the case of a two-high mill, it is necessary for the screw downs to act rapidly. For this purpose, motors **40** are directly connected to the drive

screws 41 of the two screw downs. A brake 42 of conventional form is provided on the drive shaft from the motors to one of the screw downs. In the case of the four-high mill, the operation of the screw downs is preferably at a slower rate. To provide this, a separate motor 43 is mounted on one of the housings and is connected through gear boxes 44 and disengaging clutches or couplings 45 to the drive shafts of the motor 43. When it is desired to operate the mill as a four-high mill, the couplings 45 are engaged by means of the lever 46 and air cylinder 47 and the motor 43 drives through the gear boxes 44, the couplings 45 and through the shafts of motors 40 which are deenergized and act generally as a straight through coupling. When it is desired to use the mill as a two-high mill, the couplings 45 are disconnected which removes motor 43 and gear boxes 44 from the system. The drive is then through the motors 40. Spaced from the mill stand, there is provided a roll sled carrier 48 which extends parallel to the pass line. The roll carrier 48 is provided with spaced parallel guideways 49, each adapted to receive a roll sled 27. The roll carrier 48 is in turn mounted on runners 50 and is moved parallel to the pass line by means of pistons 51 and 52 operating in cylinders 53 beneath the roll carrier 48. Pistons 51 and 52 move the roll carrier so that one of the guideways 49 is aligned with a corresponding guideway 54 which enters the windows of the housing to carry the sled into position in the roll stand. Alongside the roll carrier and in alignment with the guideway 54 there is provided a traveling rack 55 operated by a pinion 56. The end of the rack is provided with a keyhole slot 57 which is adapted to engage a keyend 58 of T-shape form on the end of the sled. The rack 55 moves the sled 27 from the windows in the housing along the guideway 54 onto the guideways 49 of the roll carrier or alternatively pushes the sled 27 from the guideways 49 of the roll carrier onto the guideway 54 and into position in the windows of the mill stand. The rack travels on a table 59 extending away from the roll carrier and is held down by a hold down roll 60 above the pinion.

When it is desired to change the type of mill, the operation is as follows:

Assume that the four-high set of rolls are in position in the mill stand. In such event, the screw downs are operated to raise them out of contact with the upper beam 32. The piston 17 is actuated to raise the beam carrier 25 and with it the upper beam 32 and the upper backup and work rolls. A spacer 61 having an opening 62 adapted to fit over pin 63 on the bottom beam is inserted onto pin 63. The upper part of the spacer carriers a pin 64 which is adapted to enter an opening 65 in the bottom of the upper beam. Two spacers are used at each end of the beams making four in all. The piston 17 is then permitted to lower resting the weight of the upper beam and its associated rolls onto the spacer 61 and, in turn, onto the lower beam 29. The keyhole slot 57 of the rack is engaged onto the keyend 58 and the sled and roll assembly are withdrawn on guideway 54 onto the empty guideways 49 on the roll carrier 48. When the sled 27 is clear of guideway 54 the keyend 58 and keyhole slot 57 are disengaged the cylinder 53 is actuated so that the pistons 51 or 52, as the case may be, move the roll carrier 48 until the guideway carrying the two-high set of rolls is in alignment wth guideway 54. The keyhole slot 57 on the rack is then engaged on the keyend 58 of the sled 27 carrying the two-high set of rolls. The sled is then moved off of the guideways 49 onto the guideway 54 by actuating the pinion 56 driving rack 55 to move the sled through the windows of the mill stand and position the set of rolls in the stand. As the set of rolls move into housing windows the ears 34 on the upper beam slide into the channels 26 of the transverse beam carrier 25. When the upper and lower beams are in position, air cylinders 66 are actuated to force the links 67 in a direction to straighten the scissor link 68 which

moves the locking lugs 69 into slots 70 in the upper and lower beams to hold them in the housing windows. The air cylinder 47 is actuated to disengage the couplings 45 and the screw downs are then operable by motors 40. The piston 17 is raised to lift the upper beam 32 a sufficient distance to permit removal of the spacers 61 and then lowered until the rolls make contact. The screw downs are actuated to provide the necessary pressure on the rolls and the mill is in condition for operation.

In the foregoing specification, I have set out certain preferred embodiments of my invention. It will be understood, however, that this invention may be otherwise embodied within the scope of the following claims.

I claim:

1. A rolling mill structure comprising a rolling mill stand having spaced housings on opposite sides of a rolling mill pass line, windows in said housings adapted to removably receive vertically aligned rolls, a plurality of sets of vertically aligned rolls, each set mounted in upper and lower roll carrying beams extending between the housings into the windows thereof on transport means adapted to be interchangeably inserted in said windows with their axis transverse to the pass line, means for selectively moving said sets of rolls parallel to and spaced from said pass line into alignment with said windows, means adjacent the roll stand acting on said transport means to move the aligned set of rolls and at least the lower roll carrying beams horizontally selectively into and out of the housing windows, screw down means acting on the roll carrying beams to transmit pressure to the rolls and locking means on the housing releasably holding the set of rolls in said windows.

2. A rolling mill structure comprising a rolling mill stand having spaced housings on opposite sides of a rolling mill pass line, windows in said housings adapted to removably receive vertically aligned rolls, a plurality of sets of vertically aligned rolls, each set mounted in upper and lower roll carrying beams extending between the housings into the windows thereof on transport means adapted to be interchangeably inserted in said windows with their axis transverse to the pass line, table means having spaced guideways corresponding in number to the number of sets of rolls for selectively moving said sets of rolls and associated transport means parallel to and spaced from said pass line into alignment with said windows, means adjacent the roll stand acting on said transport means to move the aligned set of rolls and at least the lower roll carrying beams horizontally selectively into and out of the housing windows, screw down means acting on the roll carrying beams to transport pressure to the rolls and locking means on the housing releasably holding the set of rolls in said windows.

3. A rolling mill structure comprising a rolling mill stand having spaced housings on opposite sides of a rolling mill pass line, windows in said housings adapted to removably receive vertically aligned rolls, a pair of sets of vertically aligned rolls, each set mounted in upper and lower roll carrying beams extending between the housings into the windows thereof on transport means adapted to be interchangeably inserted in said windows with their axis transverse to the pass line, table means having two spaced guideways, means for selectively moving one of said sets of rolls and associated transport means parallel to and spaced from said pass line into alignment with said windows, rack means adjacent the roll stand acting on said one of said transport means to move the aligned set of rolls and at least the lower roll carrying beam horizontally selectively into and out of the housing windows, screw down means acting on the roll carrying beams to transmit pressure to the rolls and locking means on the housing releasably holding the set of rolls in said windows.

4. A rolling mill structure comprising a rolling mill stand having spaced housings on opposite sides of a rolling mill pass line, windows in said housings adapted to removably receive vertically aligned rolls, a vertically mov-

able beam carried in and extending between said housings, means for moving said beam in the vertical direction, a plurality of sets of vertically aligned rolls, each set mounted in upper and lower roll carrying beams on transport means adapted to be interchangeably inserted in said windows with their axis transverse to the pass line, the upper roll carrying beam forming a part of said sets of rolls and carrying an upper roll, said upper roll carrying beam being adapted to slidably engage the beam carrier and be raised and lowered thereby, means for selectively moving said sets of rolls parallel to and spaced from said pass line into alignment with said windows, means adjacent the roll stand acting on said transport means to move the aligned set of rolls and the roll carrier beams horizontally selectively into and out of the housing windows, screw down means acting on the roll carrying beams to transmit pressure to the rolls and locking means on the housing releasably holding the set of rolls in said windows.

5. A rolling mill structure as claimed in claim 4 having screw downs in each housing acting on the beam means and a plurality of drive means selectively engaging the screw downs to drive them at different speeds.

6. A rolling mill structure as claimed in claim 5 in which one drive means is directly connected to the screw downs and the other drive means is disengageable to drive through the first drive means.

7. A rolling mill structure comprising a rolling mill stand having spaced housings on opposite sides of a rolling mill pass line, windows in said housings adapted to removably receive vertically aligned rolls, an upper roll carrying beam extending through said windows and between said housing and adapted to carry the chocks of an upper roll, a lower roll carrying beam extending through said windows and between said housings adapted to carry the chocks of a lower roll, means adjacent the housing for moving the lower roll carrying beam and the upper roll carrier beam together with the rolls carried thereby horizontally into and out of the housing windows and screw down means acting on the upper roll carrying beam to urge it under pressure toward the lower beam and to transmit said pressure to the rolls.

8. A rolling mill structure as claimed in claim 7 wherein the upper beam is slidably removable from a beam carrier extending through the windows and means for raising and lowering said carrier.

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