

H. SACK, DEC'D.  
A. SACK, ADMINISTRATRIX.  
ROLLING MILL.

APPLICATION FILED JUNE 26, 1907.

Patented Nov. 2, 1909.

5 SHEETS—SHEET 1.

939,169.

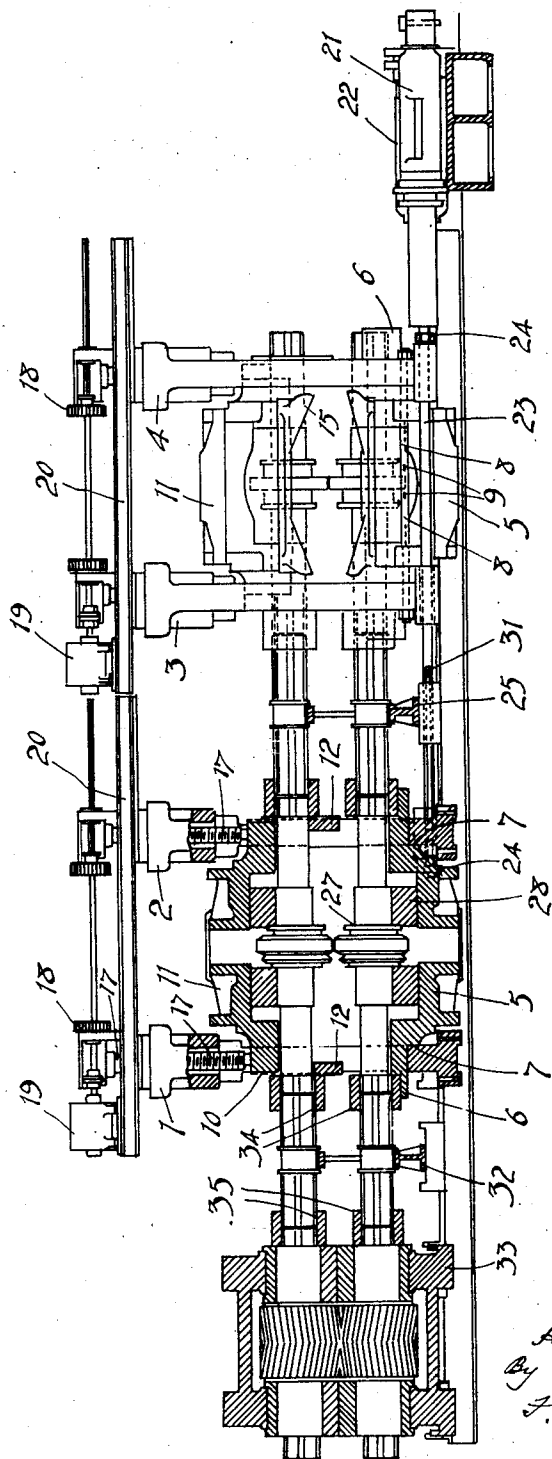


Fig. 1

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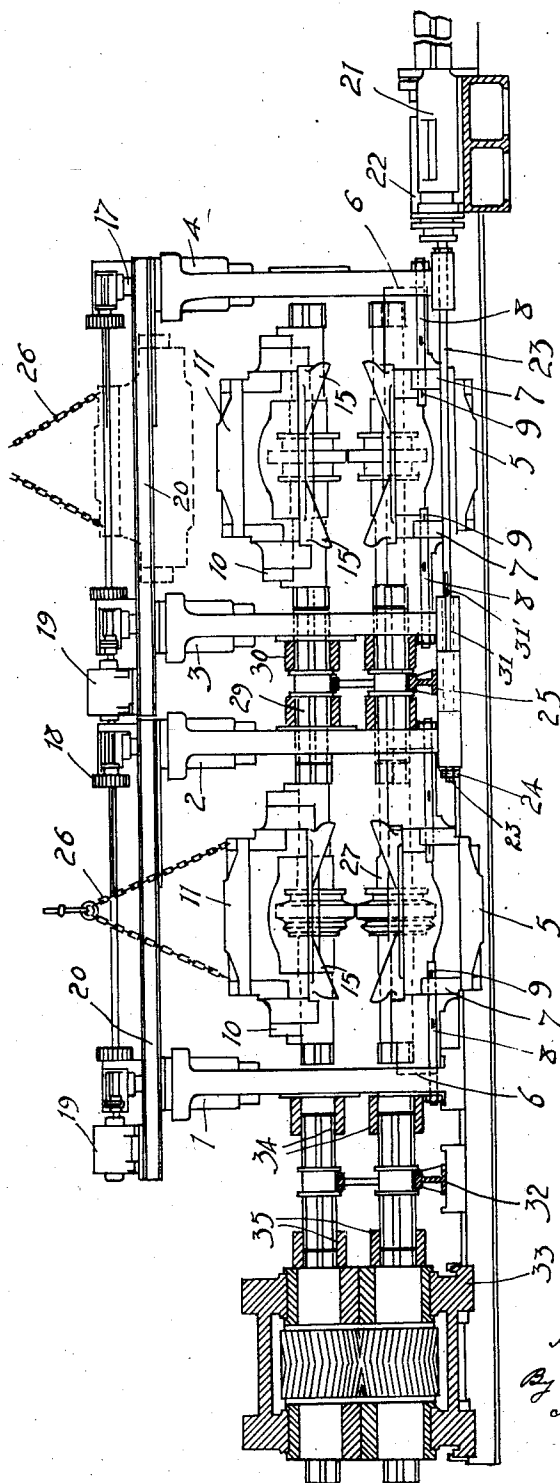


Fig. 2

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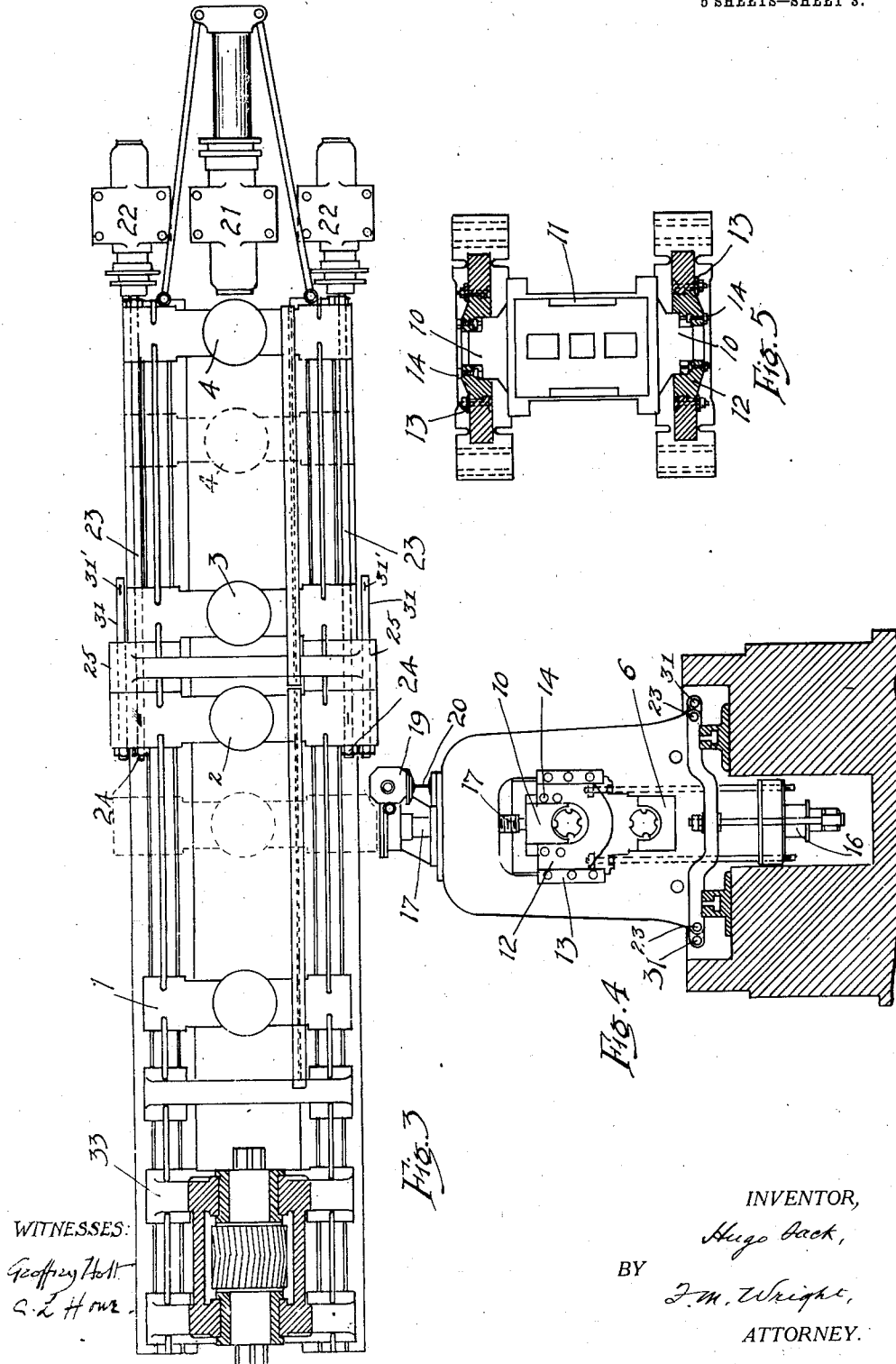
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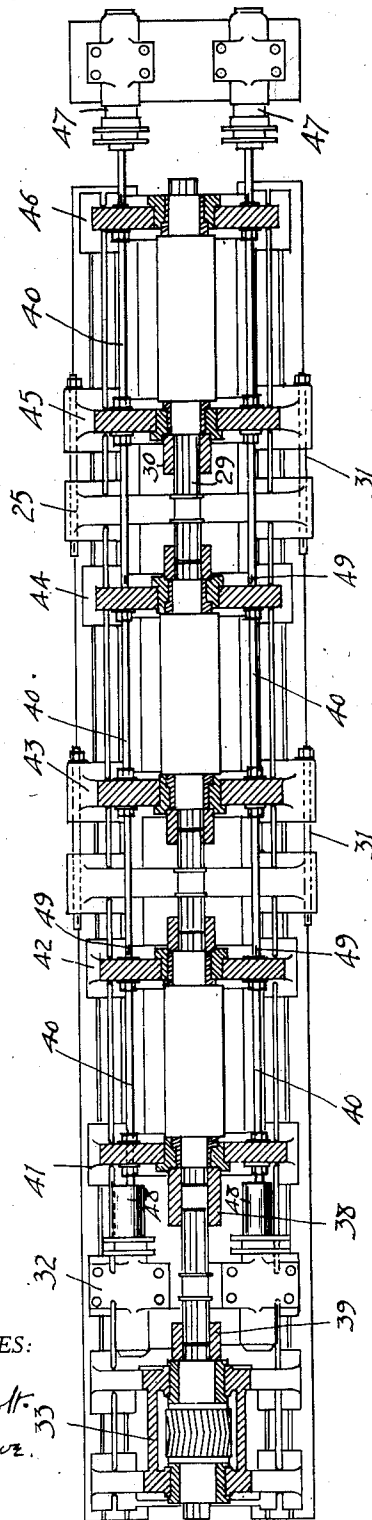


Fig. 6

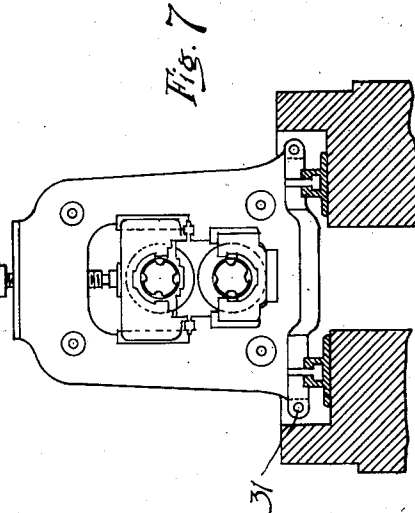


Fig. 7

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6 SHEETS—SHEET 5.

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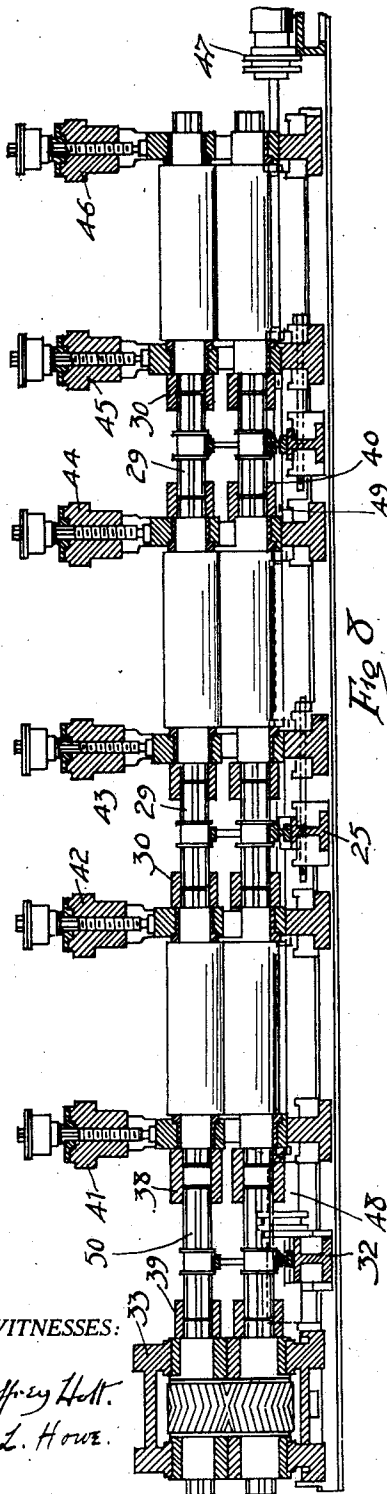


Fig. 8

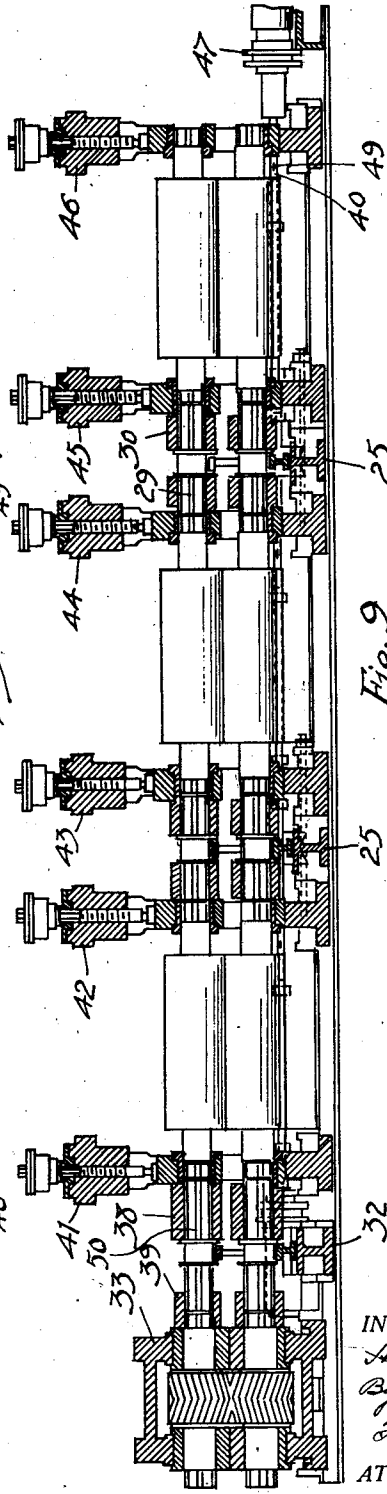


Fig. 9

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# UNITED STATES PATENT OFFICE.

HUGO SACK, OF DUSSELDORF, GERMANY; ADELHEID SACK ADMINISTRATRIX OF SAID  
HUGO SACK, DECEASED.

## ROLLING-MILL.

939,169.

Specification of Letters Patent.

Patented Nov. 2, 1909.

Application filed June 26, 1907. Serial No. 380,854.

*To all whom it may concern:*

Be it known that I, HUGO SACK, a citizen of the German Empire, residing at Dusseldorf, Rhenish Prussia, Germany, have invented new and useful Improvements in Rolling-Mills, of which the following is a specification.

The object of the present invention is to provide, in that class of rolling mills of which the housings have non-detachable tops, an improved construction which will allow of rapid removal and replacement of the rolls of the mill. The invention will be shown in the first instance as applied to a universal girder rolling mill such as that described in British Letters Patent No. 23,932 of 1905, but it is equally applicable to any ordinary two-high or three-high mill, and to trains having any number of stands of rolls.

In the universal rolling mill described in said Letters Patent, housings are shown of the open type, that is, with detachable tops. Now, if it is required to use housings with non-detachable tops, in order to obtain greater strength and rigidity, which is, of course, a very great advantage, considerable difficulty is experienced in the removal and replacing of the rolls. The object of the present invention is to provide a construction by which this difficulty is overcome.

In the accompanying drawings, Figure 1 is a front elevation, partly in section, of a universal girder-rolling mill of the character described in said British patent above referred to; Fig. 2 is a similar view of the same showing the parts in the position assumed during removal of the rolls; Fig. 3 is a plan view of the mill, certain parts being omitted; Fig. 4 is a vertical cross section thereof; Fig. 5 is a horizontal section; Fig. 6 is a plan view of the modified form of mill shown also in Figs. 7, 8 and 9; Fig. 7 is a vertical section of the same; Fig. 8 is a sectional side view of said modified form, the housings being at their normal distance apart; Fig. 9 is a similar view of the same after the housings have been moved wide apart.

Referring to the drawings, the housings 1, 2, 3, 4, are of the form usual in closed housings, and are such as could be employed for a reversing mill, so that in place of the universal mill rolls described in said patent, ordinary two-high rolls could be

employed in the housings, and the same train could be employed equally well both for a universal mill and for a section, or bar, mill. This is naturally a great advantage, and one that has not previously been obtained in any other form of universal girder-mill.

By means of pairs of said housings are supported the lower roll frames 5, their ends 6 extending into the openings in the housings. Each lower frame has shoulders 7, which fit exactly between the two housings of its stand, as clearly shown in Fig. 1, so that said frames likewise serve as distance pieces for maintaining said housings at their normal distance apart. The distance to which the housings can move from one another is limited by means of bolts 8, which pass through said shoulders 7 and also through the housings, and which are provided with suitable cotters 9.

The ends 10 of the upper frames 11 fit into the bearings 12, which bearings can move up and down in the housings, and are guided by means of guide pieces 13, best shown in Figs. 4 and 5. The endwise movement of each frame is limited by means of screws 14. The vertical rolls described in the specification of said Letters Patent are omitted in order to simplify the drawings, although the guides 15 for these vertical rolls, with their inclined faces, appear. It is evident from the above described construction that, so long as the housings remain stationary, the upper frame, their bearings therefor, and the upper horizontal roll, can have a vertical movement only. The weight of these parts, that is, the bearings, upper frame, and upper roll, is counterbalanced by rods 16' actuated by any usual means such as an hydraulic cylinder 16, one of these cylinders being arranged under each housing, although, for clearness of illustration, these counterbalancing cylinders are omitted in Figs. 1, 2 and 3. Such cylinders, not here shown, are also provided for the stools of the intermediate spindles. The raising and the lowering of the upper roll and the corresponding frame are controlled by means of screws 17, gearing 18 and motors 19, in the usual manner, said motors being carried on H-beams 20.

In order to change the rolls in a universal girder-mill, the housings are moved apart by means of an hydraulic cylinder. This has already been done in the case of bloom

mills, but in the present apparatus such mechanism is employed, not only for simultaneously moving apart the housings of two or more stands, but also to perform the same function for the spindles and wabblers, and to draw off the coupling collars, so as to leave the roll ends free. In Figs. 1 to 5 are shown two stands, the one on the left carrying the roughing rolls, and that on the right the finishing rolls. As shown, however, in Figs. 7, 8, and 9, the process of rolling can be distributed over three or more stands in the same train, and one housing of each stand can be slid apart from the other housing thereof in a single movement. In the mechanism shown in Figs. 1, 2 and 3, this longitudinal movement is only applied to the housings 2 and 4. This is done by means of the hydraulic cylinders 21 and 22, of which the single cylinder 21 moves said housings 2 and 4 to the right, to separate them from the other housings 1 and 3 of the stands, while the two cylinders 22 return the housings to their original position.

The apparatus required for the above mentioned changing of the rolls, frames, and other parts, is best shown in Fig. 3. The housings 2 and 4 to be moved are connected together by means of distance rods 23, which are connected by nuts or cotters 24 to the several housings. The rods 23 slide freely through the fixed housing 3 and through the spindle tool 25. This stool also slides, being moved toward housing 3 by the shifting of the housing 2 and adjacent couplings 30 and being returned to its normal position by the rods 31, in the free ends of which are cotters 31' which strike the base of the stool. The other ends of the rods 31 are secured to the housing 2.

Fig. 2 illustrates the manner in which the complete upper frames with their guides 15, and also the upper horizontal rolls, can be lifted out together. Since the H-beams 20, for connecting the housings at the top and for supporting the motors, are arranged at the side, as shown in Figs. 1, 2 and 4, the crane is enabled to have free access to the parts to be lifted, so that the crane chains 26 can be easily connected to said parts and they can be lifted from the middle to one side, as best shown in Fig. 3. When removing the rolls, the following is the method of procedure. After the housings have been drawn apart, the upper frame with the upper horizontal roll is first removed, then the vertical rolls are removed, and lastly the lower horizontal roll 27. The lower frame 5, with its guides, and its bearings 28, remains in the housings, and for this purpose, as shown in Fig. 2, the ends 6 of each lower frame 5 are formed long enough to remain supported by its housings after the latter have been separated. However, the same result would be obtained by providing a suit-

able support for the lower face of the lower frame, on which support it can move horizontally.

In assembling a new set of rolls in a stand, the housings would of course be first placed at a sufficient distance apart, as shown in Fig. 2. Then, first, the lower horizontal roll 27 is placed in the bearings 28 of the lower frame 5. Then follows the upper horizontal roll, and lastly the upper frame 11. The housings of each pair are then moved together again, and properly connected up.

When preparing to move the housings apart, care must be taken to see that each connection is loosened midway between the two housings, and that the spindles 29 bearing the couplings 30 are quite clear to their ends. On closing up the housings again, the stool 25 for the coupling-spindles is slid back again into its normal position midway between the two housings of a pair, while at the same time the collars or couplings 30 are slid on to the ends of the new set of rolls by hand or otherwise, and the whole train is again coupled up.

For simplicity of construction it is desirable that, in disassembling or assembling, all movable parts should be moved in the same direction. The rolls are therefore moved with one of the housings of their pair, and to permit of said rolls being moved lengthwise to clear the stationary housing it is necessary also to move back the stool and the spindles carried thereby. In this movement the stool 32, between the housing 1 and the pinion housing 33, takes no part. So also the couplings 34, 35, for the spindles between the pinion housing and the stand nearest to it remain unmoved. The rolls of the first stand simply slide out of their coupling sleeves or collars 34, and are guided in again when the housings are moved together again. To permit such movements of the housings, with their counterbalancing apparatus, suitable connections for the hydraulic counterbalancing cylinders, both of the rolls and of the spindle stools, are provided, such as jointed pipes, flexible tubing, or pipes sliding through stuffing boxes.

In Figs. 6 to 9 the invention is shown as applied to the rapid changing of the rolls of an ordinary rolling mill, for example, a reversing mill, which has three stands of rolls, and in which each pair of housings are separated at the same time, as well as the coupling collars removed from the ends of the rolls.

Figs. 6 and 8 show the train with the normal distance between the housings, and Fig. 9 shows the same train after the housings have been moved apart. In order that it may be possible to remove the couplings 38 and 39 between the pinion housing 33 and the first housing of the first stand, the housings are now moved in the reverse direction

to that in the modification shown in Figs. 1 to 5, the left hand housings, namely 41, 43, 45, being now moved to the left, those on the right, 42, 44, 46, remaining stationary. These 5 housings are all connected at the bottom by means of very powerful connecting rods 40 actuated by the hydraulic cylinders 47, 48 at opposite ends of the train, and provided with cotters 49. If any housing is not re- 10 quired to be moved the cotters 49 are simply taken out, so that the rods 40 pass freely through these housings without moving them. This also applies to the top connections and the holding down bolts, by means 15 of which the housings and stools are secured by the bed plate. In this way it is plain that, by admitting pressure water to the hydraulic cylinders, any desired housing or stool can be moved laterally, sliding on the 20 bed plates, which are of the usual form. This lateral movement is continued until the train has arrived at the position shown in Fig. 9, and the coupling collars 30 are thereby slid along the coupling spindles 29 25 until the ends of the rolls are left quite free. The rolls are still supported at the ends of their journals in the bearings, but they can be lifted clean out by a simple operation without necessitating the removal of the 30 bearings.

The collars 38 between the first stand and the pinion-housing 33 are made somewhat longer than the others, and the intermediate spindles 50 between the pinion housing 33 35 and the first stand are made correspondingly shorter than the distance between the pinion ends and beginning of the first stand of rolls, the difference being sufficient to allow of the sliding of the stand housings toward 40 the pinion housing. Otherwise the method of procedure is the same as that already described in regard to the first construction. The stools 25 of the intermediate spindles slide a certain distance, and are brought 45 back by the rods 31 into their original position midway between the two neighboring stands, as soon as the housings are themselves brought together again by the hydraulic cylinders 47. The stool 32 between 50 the pinion housing and the first stand does not take part in the movement, but remains stationary.

I claim:—

1. In combination with a pair of housings 55 constituting a mill stand, a roll-supporting member having sliding connections with the housings and adapted to support a roll therebetween, said housings and member being constructed and arranged to permit the

housings to be moved apart and the roll to 60 be lifted from its support.

2. In combination with a pair of housings constituting a mill stand, a roll supporting member having sliding connections with the 65 housings and adapted to support a roll therebetween, said housings and member being constructed and arranged to permit the housings to be moved apart and the roll to be lifted from its support while the support 70 is held in place by its connections with the housings, substantially as described.

3. In combination with a pair of housings constituting a mill stand, a roll supporting member having sliding connections with the 75 housings and adapted to support a roll therebetween, said housings and member being constructed and arranged to permit the housings to be moved apart and the support to be lifted from between the housings, sub- 80 stantially as described.

4. In a rolling mill, the combination of a plurality of stands of housings in line, one stand of each housing being movable to and from the other, longitudinally-movable 85 spindles between the stands, and means for simultaneously shifting the movable housings and spindles in the same direction, substantially as described.

5. In a rolling mill, the combination of a plurality of stands of housings in line, the 90 inner stand of one housing being movable to and from the other housing, longitudinally-movable spindles between the stands, and a movable stool supporting said spindles.

6. In a rolling mill, the combination of a 95 plurality of stands of housings in line, the inner stand of one housing being movable to and from the other housing, longitudinally-movable spindles between the stands, a movable stool supporting said spindles and 100 means connected to said movable stand for returning said stool to its normal position.

7. In a universal rolling mill, stands having guideways, a pair of horizontal rolls, horizontal-roll carriers extending between 105 and having ends in said guideways, devices on the upper horizontal-roll carrier whereby vertical movement of said carrier shifts the vertical rolls, and counterbalancing means supporting each end of said upper carrier. 110

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HUGO SACK.

Witnesses:

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ALFRED POHLMAYER.