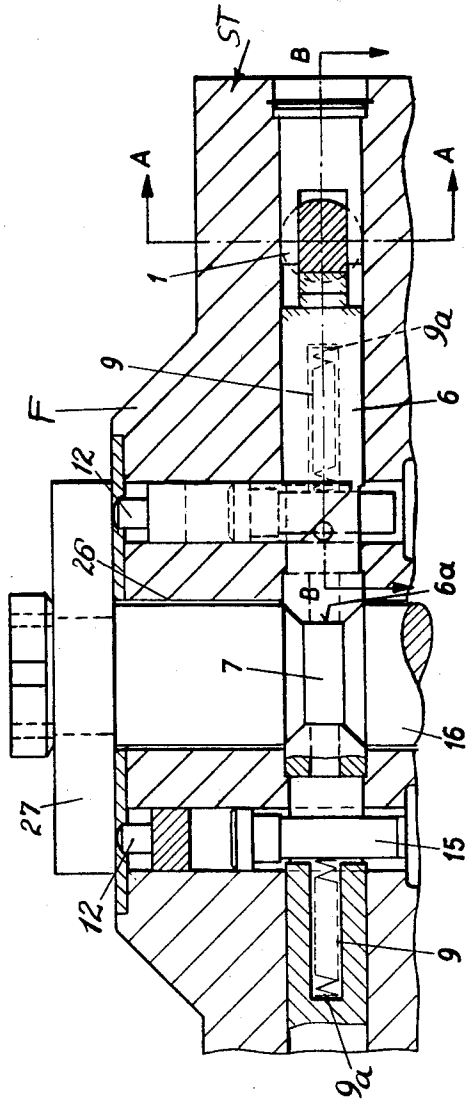
Sept. 1, 1964 H. WEBER 3,146,643

ROLLING MILLS

Filed March 24, 1960 7 Sheets-Sheet 1

Fig. 1



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Sept. 1, 1964 H. WEBER 3,146,643

ROLLING MILLS

Filed March 24, 1960 7 Sheets-Sheet 2

Fig. 2

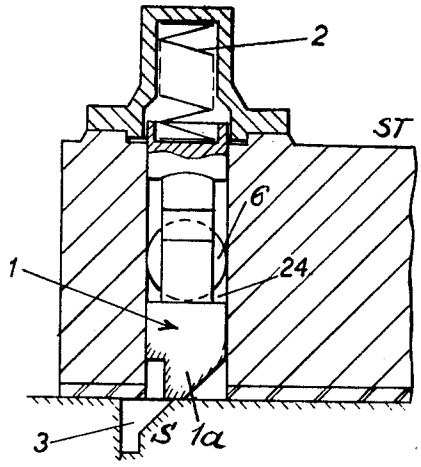
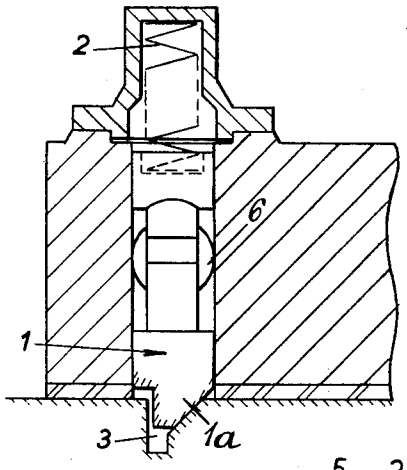


Fig. 4



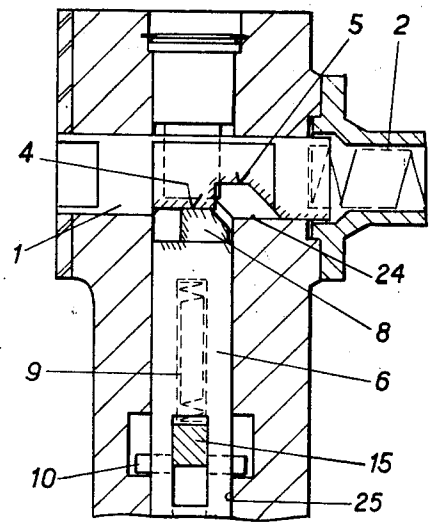


Fig. 3

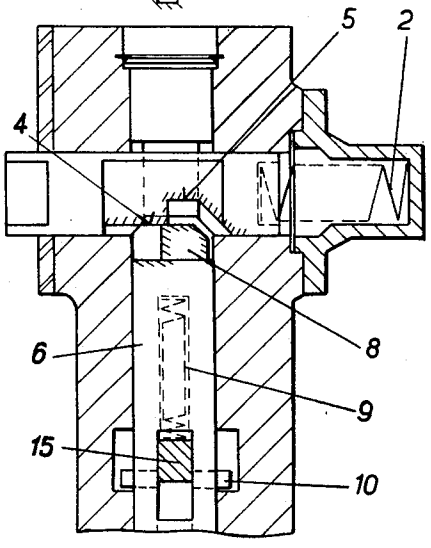


Fig. 5

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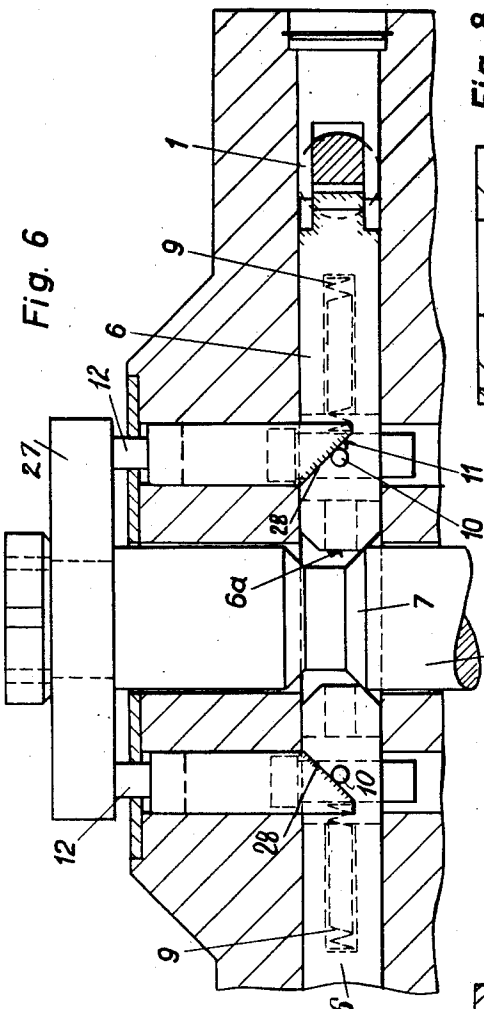
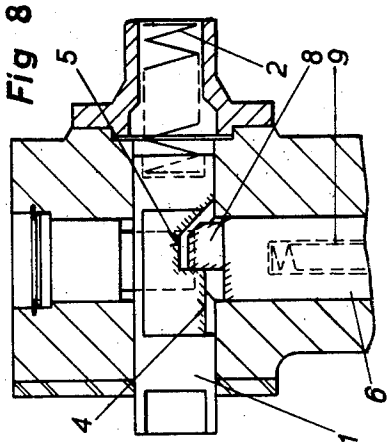
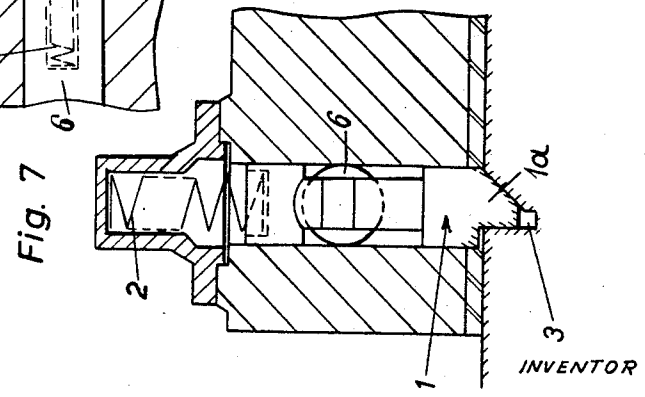
Sept. 1, 1964 H. WEBER 3,146,643

ROLLING MILLS

Filed March 24, 1960 7 Sheets-Sheet 3







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Sept. 1, 1964 H. WEBER 3,146,643

ROLLING MILLS

Filed March 24, 1960 7 Sheets-Sheet 4

Fig. 9

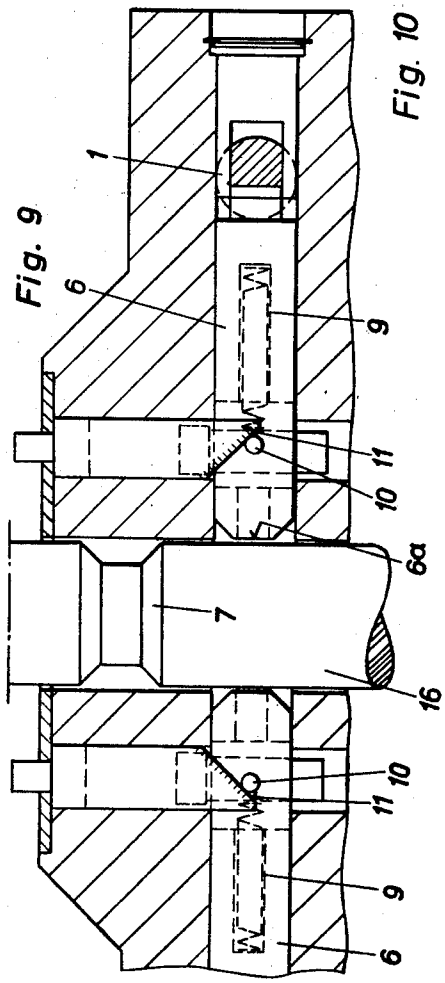
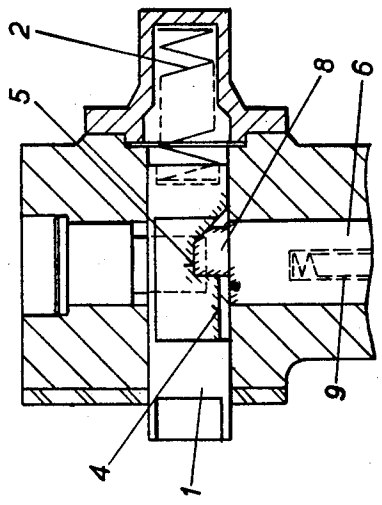


Fig. 10



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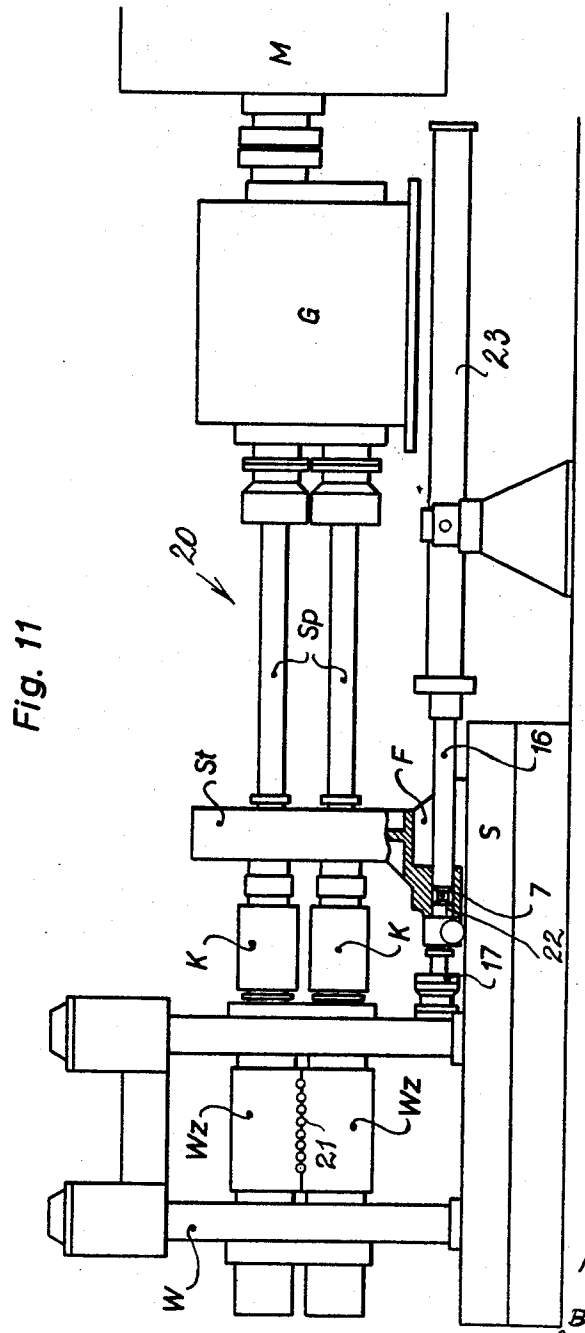
ROLLING MILLS

3,146,643

Filed March 24, 1960

7 Sheets-Sheet 5

Fig. 11



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Sept. 1, 1964 H. WEBER 3,146,643

ROLLING MILLS

Filed March 24, 1960 7 Sheets-Sheet 6

Fig. 12

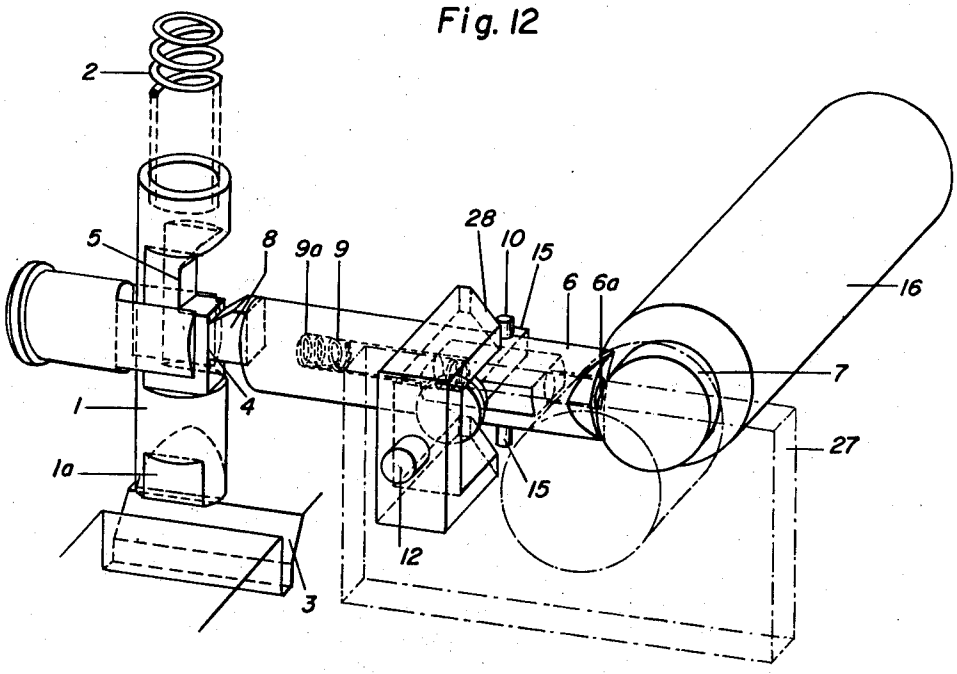
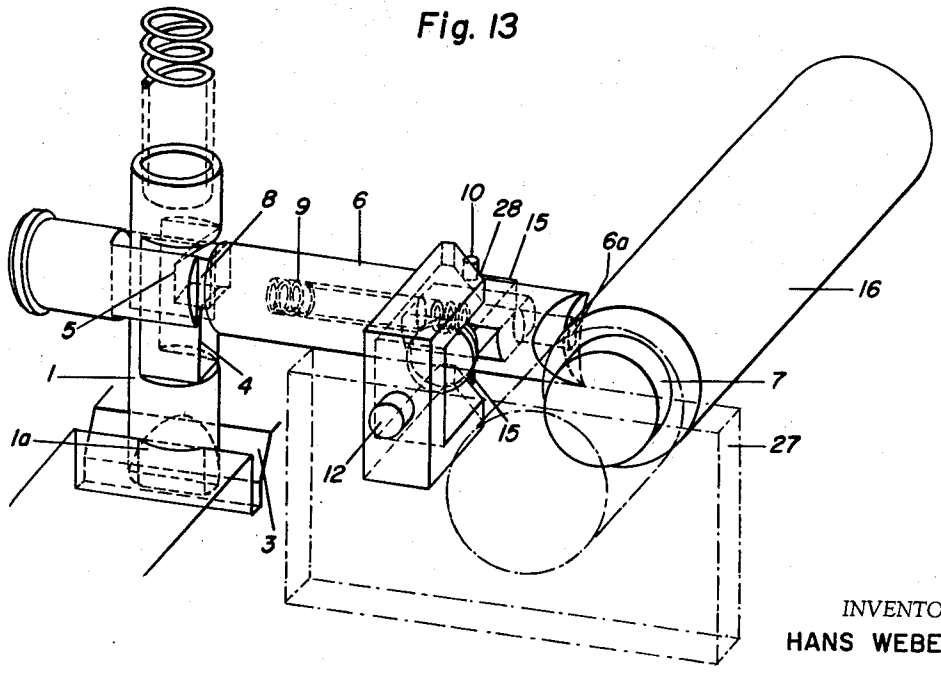


Fig. 13



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Sept. 1, 1964 H. WEBER 3,146,643

ROLLING MILLS

Filed March 24, 1960 7 Sheets-Sheet 7

Fig. 14

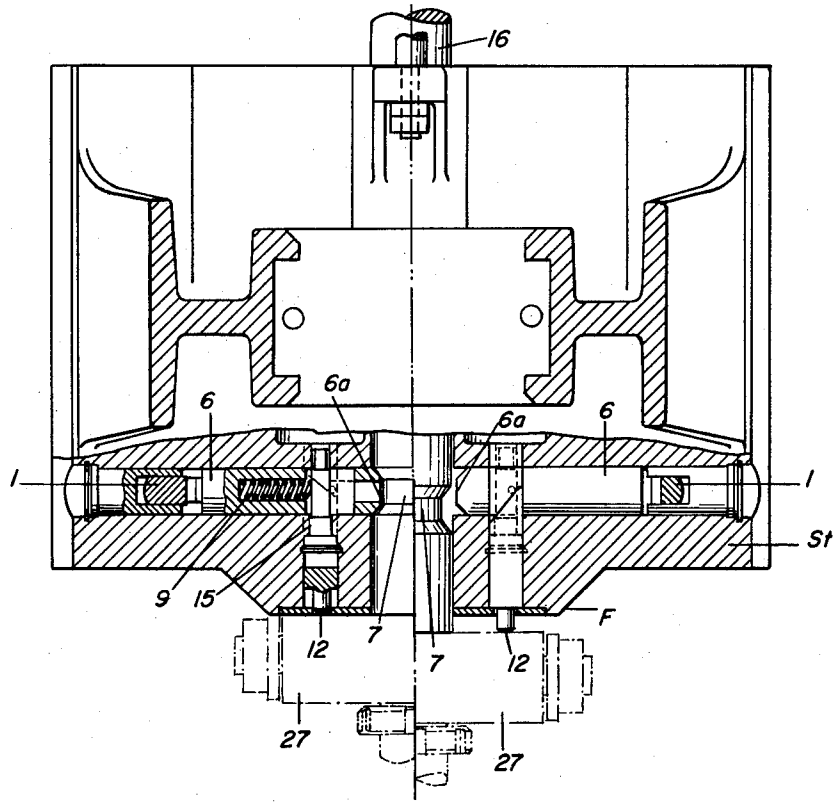
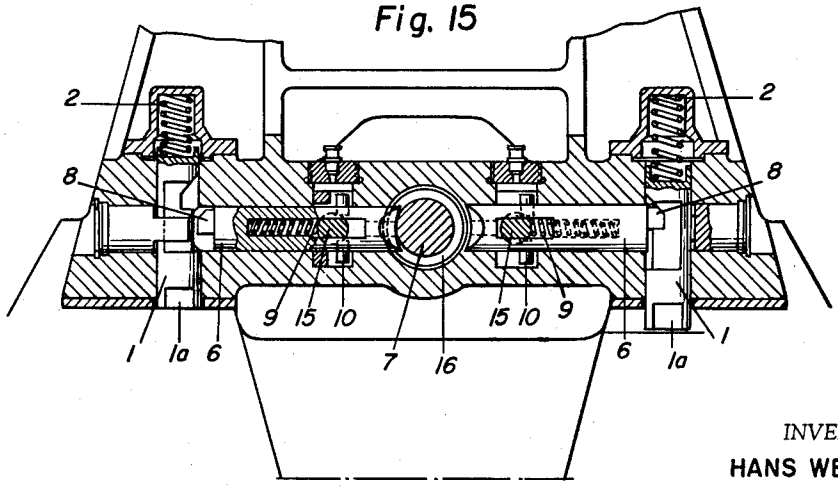


Fig. 15



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United States Patent Office 3,146,643 Patented Sept. 1, 1964

3,146,643

ROLLING MILLS

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Filed Mar. 24, 1960, Ser. No. 17,424
Claims priority, application, Germany, Mar. 28, 1959, D 30,308
9 Claims. (Cl. 80—31.1)

The present invention relates generally to rolling mills and particularly to a method and apparatus for locking the spindle carrier with the base plate.

It is an object of the present invention to provide means, in a rolling mill of the type having interchangeable roll stands and an automatic coupling between each roll and its drive spindle, for rapidly and safely effectuating the locking of the rolling mill spindle carrier or cradle with the bed or base plate thereof prior to the release of the coupling between the rolls of an interchangeable roller stand and their respective drive spindles.

It is another object of the invention to provide means facilitating a displaceable arrangement of the roll stand and spindle carrier, in their coupled condition in the direction of the rolls or spindle axes, while maintaining a fixed or constant distance or spacing between the roll stand and the cradle or carrier.

It is a further object of the invention to provide means affording an operational condition prior to the disengagement or uncoupling of the roll stand to be exchanged for another, which condition requires firm coupling or connection of the spindle carrier or cradle to the base plate, this coupling or connection being then maintained until completion of the coupling of the stands newly installed in the rolling mill. However, prior to the disengagement of the connection between the cradle and base plate, a connection or coupling is effected between the roll stand and the cradle or spindle carrier, so that the aforesaid condition always prevails during any reciprocable movements of the roller stand.

It is a still further object of the present invention to provide means which ensure the maintenance of a fixed or non-variable spacing between the roll stand and the cradle while the roll stand is transposed.

The process of the present invention is effectuated by means of an apparatus or device which, between the structural parts connecting or coupling the roll stand to the cradle with a fixed or non-variable spacing and between those parts which secure the cradle on the base plate of the rolling mill, provides a drive mechanism which may be of any suitable type, for example, mechanical, hydraulic or electrical.

In a mechanism or device for effecting the method of the present invention, the base plate of the rolling mill is provided with a fastening or locking groove and with fastening or securing pins on both sides of the groove which are vertically displaceable in the foot of the cradle, the pins being formed with lower ends having a conformation complementary to that of the groove biased in a downward direction by a spring. The pins are provided with a locking groove defined in one side face thereof. After the lower end of the fastening or securing pin has entered the groove, a lug disposed at one end of a locking pin, which extends normally to the securing pin, enters the locking groove of the latter.

The lug bears against one of the side faces of the securing pin, being under spring bias, while concomitantly therewith, the other end of the locking pin, which is in the form of a coupling piece, lifts from the keyway of a piston rod which extends, axially of the rolls, in the foot of the cradle. This movement of the locking pin is controlled by a fork which is displaceable in a direction parallel to the piston rod. The fork bears against a cross

pin secured to the locking pin by a face, at one end thereof, which is provided with the same inclination as the coupling piece and the groove, the other end being supported on an abutment plate which is rigidly secured to the piston rod.

The above and other objects of the invention will become further apparent from the following detailed description, reference being made to the accompanying drawings showing preferred embodiments of the invention.

In the drawings, which illustrate the best mode presently contemplated for carrying out the invention:

FIG. 1 is an enlarged horizontal section taken through the cradle foot of a rolling mill pursuant to the present invention at the location of the broken away sectional portion shown on smaller scale in FIG. 11;

FIG. 2 is a sectional view taken along line A—A of FIG. 1 and illustrates a fastening or securing pin immediately prior to its engagement in a fastening groove defined in the base plate;

FIG. 3 is a sectional view taken along line B—B of FIG. 1 and illustrates the lug of a locking pin bearing against one side of a securing or fastening pin, and a locking groove defined therein;

FIG. 4 is a view similar to FIG. 2 but rotated 90° and illustrates the locking pin partially inserted in the locking groove;

FIG. 5 is a view similar to FIG. 3 but rotated 90° and illustrates the changed bearing of the lug of the locking pin against the side of the securing or fastening pin, in comparison with the position shown in FIG. 3, the fastening pin being in the position thereof illustrated in FIG. 4;

FIGS. 6, 7 and 8 are similar to FIGS. 1, 2 and 3, respectively, but illustrate the final position of the securing or fastening pin in the fastening groove, the lug of the locking pin being partially inserted or engaged in the locking groove;

FIGS. 9 and 10 are similar to FIGS. 1 and 3, respectively, but illustrate the final end position of the locking pin in the locking groove;

FIG. 11 is a view, in elevation, of a horizontal rolling mill provided with a locking device, pursuant to the present invention, in the spindle foot;

FIG. 12 is a perspective view of the locking arrangement similar to that indicated in FIGS. 1 to 10, with the parts in a position in which the bolt is not engaged in a groove of the plate F;

FIG. 13 is a perspective view of the locking arrangement with the bolts engaged in the groove of the plate and with the spindle carriers locked with the plate;

FIG. 14 is an enlarged section similar to that indicated on a smaller scale in FIG. 11; and

FIG. 15 is a section similar to that indicated in FIG. 14 but taken at an angularly rotated position in respect thereto, the left-hand portion indicating the unlocked position and the right-hand portion indicating the locked position.

Referring now to the drawings in detail, FIG. 11 illustrates a rolling mill 20 pursuant to the present invention. The mill, as here shown, comprises a horizontal roll stand W which mounts a pair of cooperating rolls WZ between which the work 21 is rolled or milled. The rolls are driven by a drive mechanism which includes a drive motor M, transmission gear means G which couple the motor to a pair of drive spindles Sp for the rolls WZ, and the coupling sleeves K which couple the spindles to the associated rolls WZ.

The roll stand W is mounted on a displaceable base plate S which displaceably or removably mounts a cradle or spindle carrier St having a foot F provided with locking means or a similar device, generally indicated by reference numeral 22. The mill is provided with a piston

rod 16 which, at the drive end of the mill, is disposed in a pivotable cylinder 23. A quick-coupling mechanism 17 couples the piston rod 16 to the stand W.

FIG. 2 illustrates the condition or disposition of the parts with the cradle S*t* unlocked from the base plate S due to the fact that a pair of fastening or securing pins 1 are not engaged in a groove 3 provided in the base plate S. As here shown, each pin 1, for releasably securing the cradle to the base plate, is movable in a bore 24 provided in the cradle and has a securing end or lug 1*a* complementary to the groove 3. It will be noted from FIG. 3 that each securing pin 1 has a side face 4 provided with a groove 5 which is complementary to a lug 8 provided on one end of a companion locking pin 6, each of which is movable in a bore 25 which is normal to bore 24. The end of each locking pin 6, opposite lug 8, is in the form of a finger or engagement part adapted to engage in a keyway 7 provided in the piston rod 16. The latter is mounted in a bore 26 defined in the foot F of cradle S*t* and is mounted therein for movement in a direction parallel to the spindles S*p*.

In order to remove the roll stand W from the mill 20, it is moved with the cradle S*t* to the left, viewing FIG. 11. The pin 1 is biased by spring 2 toward the base plate S, and when the cradle has been moved sufficiently to the left, the spring forces the lug 1*a* of securing pin 1 into the groove 3.

FIG. 4 illustrates an intermediate position in which the cradle has not been moved sufficiently for the lug 1*a* to be fully inserted into the complementary groove 4. As seen in FIG. 5, when pin 1 is in the position shown in FIG. 4, the side face 4 thereof still bears against lug 8 of the locking pin so that the lug is not inserted into groove 5 defined in the securing pin. However, when the cradle has been moved to the position shown in FIG. 7, the lug 1*a* is fully and completely engaged or inserted in groove 3 and in this position, as best shown in FIG. 5, lug 8 on locking pin 6 is fully engaged or inserted in groove 5 defined in securing pin 1.

Pin 6 is biased into the groove 5 by spring 9 which acts thereon. However, the movement or displacement of locking pin 6 by spring 9 is limited by a suitable mechanism. More particularly, one end of the spring bears against the locking pin 6 as at 9*a*, and the other end thereof bears against a guide member 15 which prevents rotation of pin 6. As best seen in FIGS. 6 and 9, provision is made for a bifurcated member 11 which is mounted for movement in a direction parallel to the piston rod 16.

The displacement of locking pin 6 under the action of spring 9 is limited by the extent to which member 11 releases a cross pin 10 provided on pin 6, the member 11 acting through pin 12 against an abutment plate 27 provided on piston rod 16. In order to provide for the unhindered or free movement of the parts, the faces 28 of the forked member 11, which bear against pins 10, the insertion end 6*a* of locking pin 6, and the keyway 7 in piston 16, all are similarly inclined, as best shown in FIG. 6.

In lieu of bifurcation means 11, there may be utilized a displacement member which has the same inclinations, or angular surfaces, which is inserted in place of the guide member 15 and assumes the functions thereof. FIG. 6 illustrates a partial displacement, to the left, of piston 16, as compared with FIG. 1. If the piston is displaced further to the left, as shown in FIG. 9, the end 6*a* of locking pin 6 is forced out of the keyway or groove 7 until said end bears against the surface of the piston, outwardly of the keyway. This causes the lug 8, at the other end of the locking pin 6, to be completely seated or inserted in groove 5 of the fastening pin 1, as shown in FIG. 10, the piston rod being completely released by the opposite end 6*a* of pin 6.

As a result, there is accomplished the simultaneous locking of the cradle to the base plate, as shown in FIG. 7, and the locking of the securing pin 1 by the locking pin 6 so that the couplings K between the rolls WZ and the drive spindles S*p* are disengaged. A roll stand is moved or coupled into the mill 20 in a reverse sequence of operations.

Referring to FIG. 2 of the drawings, there is indicated a perspective view of the locking arrangement with the parts in a position in which the bolt 1 does not engage in a groove 3 of the plate F. The carrier S*t* together with the roll stand W can therefore be displaced with the plate S by means of the piston rod 16 which, via the coupling 17, engages at the roll stand W. This joint displacement of the roll stand and the spindle carrier takes place at engaged position of coupling K, for example, when the rolls WZ are to be pushed to accommodate another size roll.

In order to be able to displace the spindle carrier with the spindles S*p* connected thereto in a position which is unchanged relative to each other in an axial direction of the spindles, it is necessary that the spindles include telescopic portions (not shown). The telescopic displacement of the spindles takes place in the roll stand indicated K*g*.

FIG. 13 shows a perspective view of the locking arrangement with the bolts engaged in the groove 3 of the plate whereby the spindle carriers are locked with the plate. This locking occurs when the roller stand simultaneously releases the coupling and is displaced to the carriage 36 for exchange purposes. In doing so, the spindle carrier maintains its locked position on the plate and the coupling members, from which the roller pin ends have moved out when the stand is taken out on the left-hand side, remain at the spindle.

FIG. 14 is a section taken at the section portion indicated in FIG. 11. This section, through the foot F of the spindle carrier, is compared with the section through the foot F in FIG. 11. The left-hand half shows the unlocked position and the right-hand half shows the locked position.

FIG. 15 is a section taken on an angularly rotated position of FIG. 11 and on the left-hand is indicated the unlocked position. On the right-hand is indicated the locked position.

Referring to FIG. 11 it can be readily seen that cradle S*t* must be moved when individual rollers 21 are to be displaced in the roller stands WZ such as when the elements 21 are to be formed in a different manner or it is necessary to change over from one kind of workpiece 21 to a different kind. A movement for the guide of the rolled goods is usually not feasible. One of the reasons for this is that the guides carry measuring devices, switches and the like and the goods, during rolling, should be deflected as little as possible from the rolling path. Therefore, the caliber which is required in each case for the rollers has to be adjusted to the center of the guide for the rolled goods.

The possibility of movement must be large enough so that the workpieces of different thicknesses, that is, from a first caliber to the last caliber, may be easily accommodated. If the rolling frame itself is moved by this amount, then the danger exists that the automatic coupling will release itself. In order to prevent this, the cradle S*t* is moved together with the rolling frame and for this purpose they are coupled together by means of a common plate S. The drive spindles S*p* are usually made so that they may be easily telescoped into each other, but this feature forms no part of the present invention.

Movement of the cradle together with the frame is required in order to adjust the rollers WZ to a correct caliber when in a working position. However, if the roller frame W is to be exchanged as a unit, then the cradle is not permitted to be moved but has to remain in its position which is the position of the frame at the moment of the releasing of the couplings K, so that after the exchange of the old frame, the new frame will have the correct position relative to the cradle. For this reason a locking arrangement is built in in accordance with the invention.

Various changes and modifications may be made without departing from the spirit and scope of the present invention, and it is intended that such obvious changes and modifications be embraced by the annexed claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A rolling mill having a movable base plate, a cradle movable on said base plate, interchangeable roll stands affixed to said base plate, and automatic coupling means between each roll and said cradle for connection to a companion drive spindle; means for interlocking said cradle to said base plate, means for moving said base plate including means maintaining said interlock between said cradle and said base plate for maintaining said coupling in spaced alignment with said cradle.

2. In a rolling mill having driving spindles for each roll stand, a base plate, a cradle movable on said base plate, interchangeable roll stands affixed to said base plate, and automatic coupling means between each roll and said cradle aligned with a companion drive spindle; a groove defined in said base plate, means for moving said roll stand having securing means displaceable in said groove, groove means defined in a face of said moving means, locking means on said cradle displaceable in a direction normal to the direction of displacement of said moving means and adapted to engage in the groove means of the latter, piston means movable axially of said rolls for shifting said rolls, and means operable by said piston means to effect engagement of said locking means in the groove means of said securing means.

3. A rolling mill as set forth in claim 2, and means to control said engagement of the locking means in the groove means of said securing means.

4. In a rolling mill having a base plate, a cradle movable on said base plate, interchangeable roll stands affixed to said base plate, and automatic coupling means between each roll and a companion drive spindle; a groove defined in said base plate, said cradle having a foot overlying said base plate, securing pins mounted for displacement in said cradle foot and biased toward said base plate, groove means defined in said base plate for engagement by said securing pins, locking pins mounted for displacement normally to said securing pins, said securing pins each having a groove defined in one face thereof and said locking pins each having one end adapted to engage in the groove of the companion securing pin, a piston for moving said roll stands extending axially of said roll and provided with a keyway, means biasing each of said locking pins to normally engage the other end thereof in said keyway, whereby movement of said piston will effect the displacement of each locking pin in a direction to move said other end thereof out of said keyway and said one end thereof into the groove of the companion securing pin to lock said cradle to said base for movement thereof with said roll stand.

5. A rolling mill as set forth in claim 4, and means mounted for displacement in a direction parallel to said piston means for controlling the displacement of said locking pins in the direction to engage said securing pins.

6. A rolling mill as set forth in claim 5, said control means being a bifurcated member having an inclined end face on each bifurcation, each locking pin having a projection abutting one inclined face of said bifurcated member, and means effecting a rigid connection between the piston and said bifurcated member.

7. A rolling mill as set forth in claim 6, the piston keyway and the other end of each locking pin having complementary inclinations substantially similar to said inclined end faces.

8. A rolling mill arrangement including a driving motor operating a pair of driving spindles, a base plate movably supported adjacent the outer end of said spindles, a roll stand mounted on said base plate including rolls adapted to be connected to corresponding spindles, a cradle arranged adjacent the ends of said spindles and movable on said base, couplings carried between said cradle and said roll stands for coupling said roll stands to said spindle, a roll stand shifting piston member mounted adjacent said spindles including a movable portion, said cradle having a bore to accommodate the movable portion of said piston, and means responsive to movement of said piston to lock said cradle to said base to effect movement of said roll stand with said cradle, whereby said roll stand is maintained in alignment and at a proper distance with the coupling connection held by said cradle.

9. A rolling mill according to claim 8, wherein said movable piston includes a cylinder portion pivotally mounted adjacent said driving spindle.

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