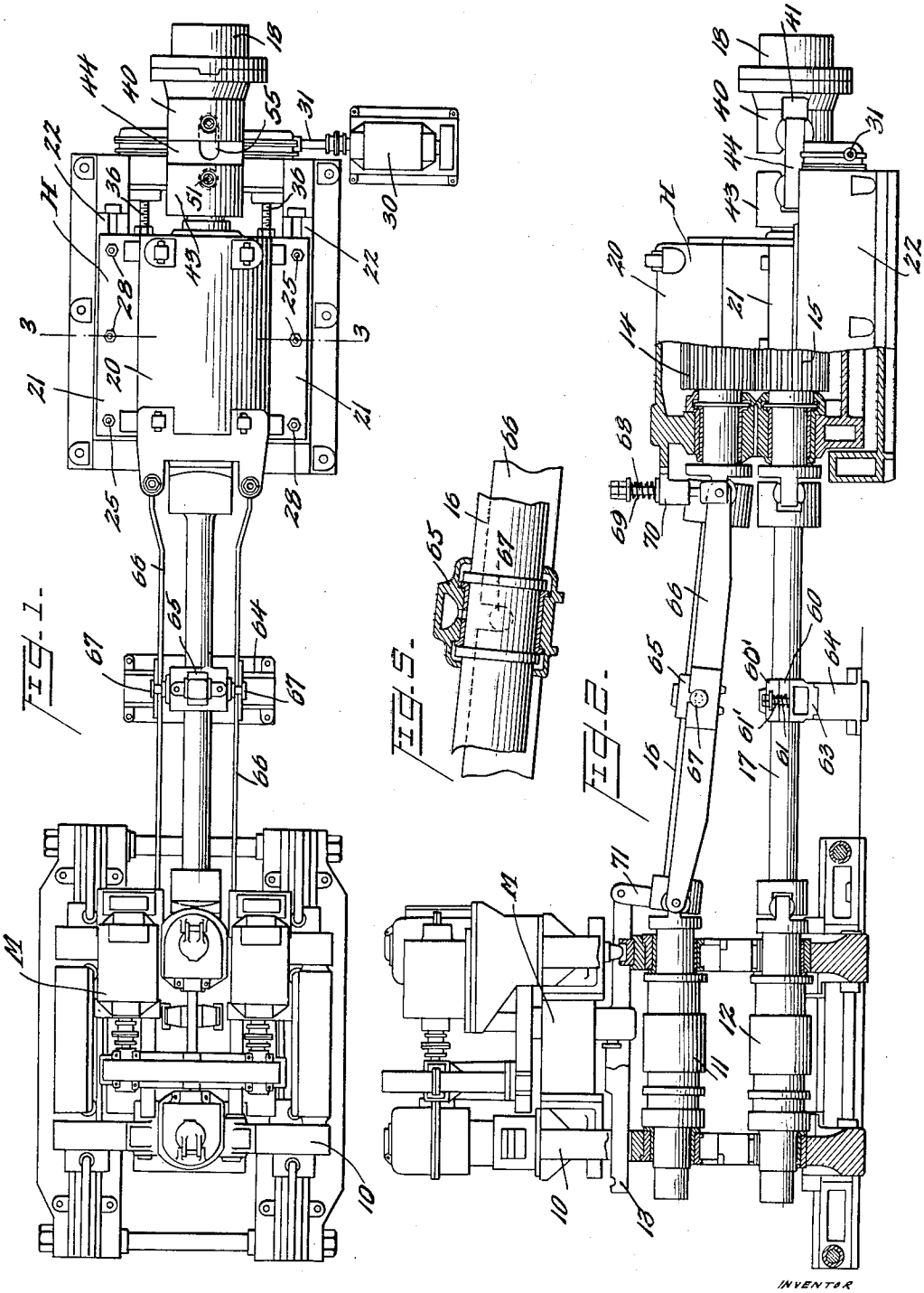
March 13, 1934. H. L. SCHRECK 1,950,573

ROLLING MILL

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FIG. 3.

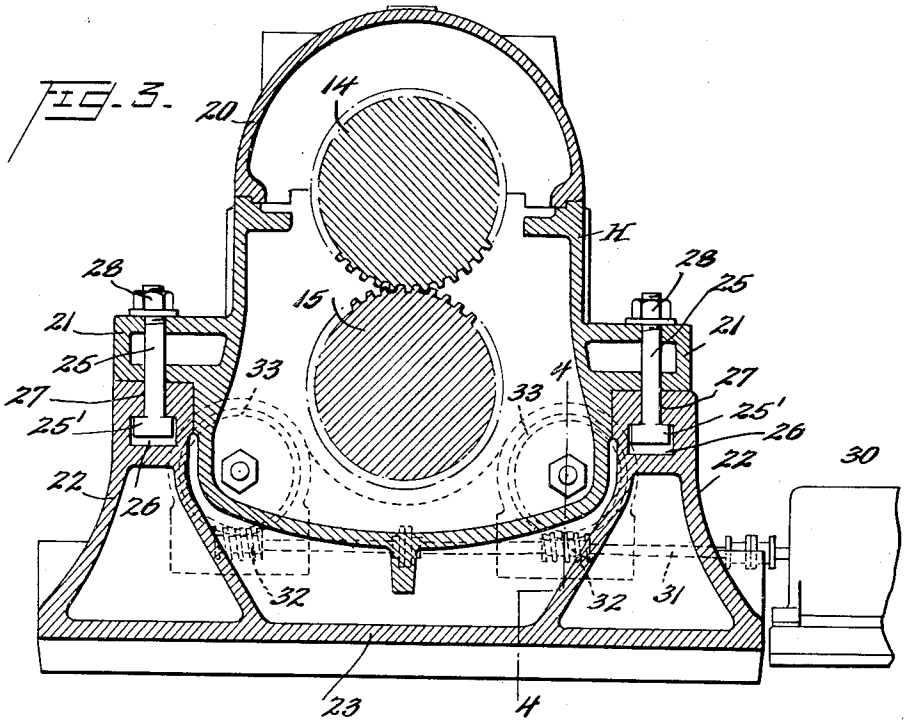
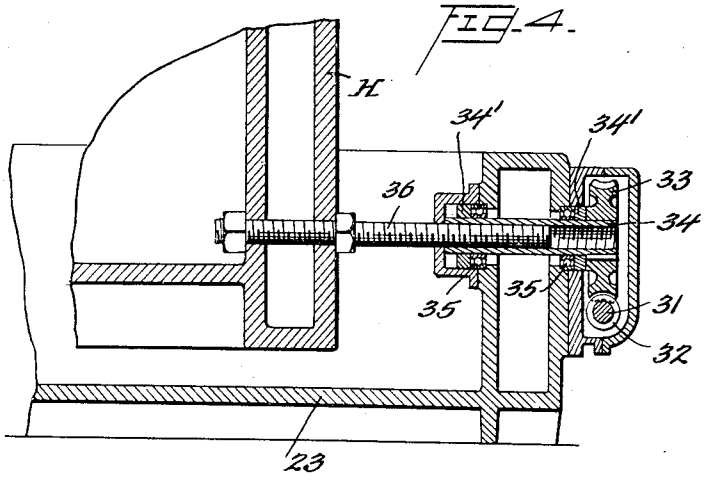


FIG. 4.



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FIG. 6.

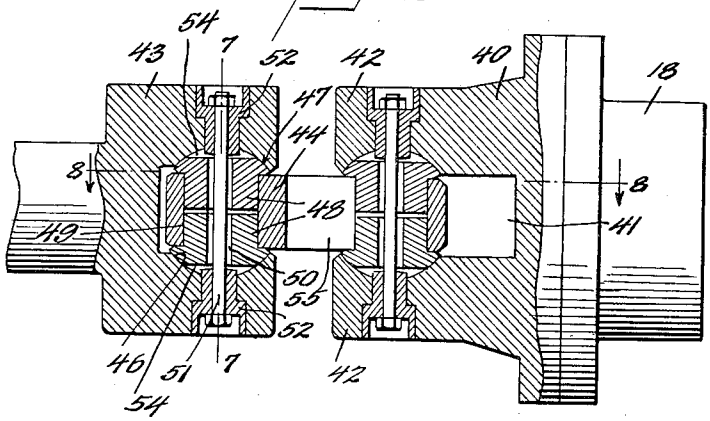


FIG. 7.

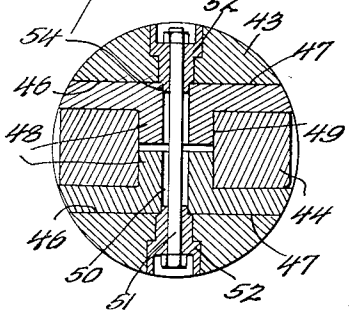


FIG. 8.

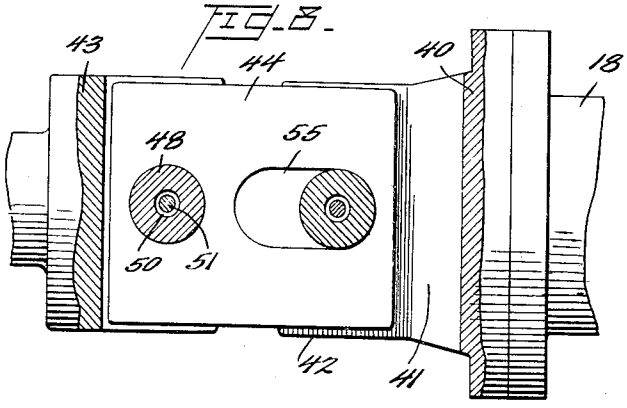
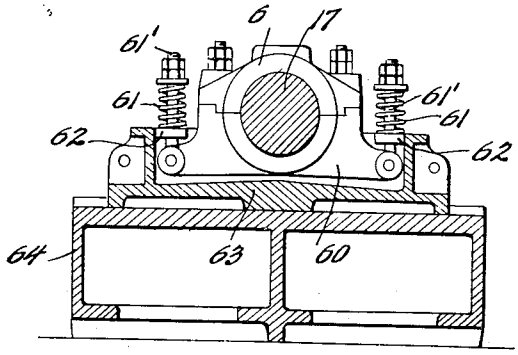


FIG. 9.



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UNITED STATES PATENT OFFICE

1,950,573

ROLLING MILL

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Application February 25, 1932, Serial No. 595,200

2 Claims. (Cl. 80—54)

The present invention relates to rolling mills and particularly to roll driving mechanisms of such mills.

A rolling mill of the type to be disclosed comprises essentially a plurality of rolls rotatably supported in a frame and means connecting the rolls to a source of power located to one side of the frame. Generally the source of power of the modern rolling mill is an electric motor of large size, and the rotor of this motor is usually connected to the mill rolls by means of gearing and spindles in such manner that the rolls are driven in opposite directions but at the same peripheral speed. Thus, the motor may drive one of two intermeshing pinions superposed one above the other, each such pinion being connected by means of a spindle to one roll of the mill. The pinions are fixed in position relatively to the mill frame, but, inasmuch as the pinions and mill rolls are not in axial alignment, each connecting spindle is provided at its ends with universal couplings, by means of which the rotary movement of each pinion is transmitted to the associated roll with a minimum of frictional loss. The universal couplings further permit vertical adjustments of the rolls relatively to the frame and the pinions, which adjustments, of course, must be frequently made in the operation of the mill.

It is also necessary, in the normal operation of mills of this type, to frequently remove from the mill frame one set of rollers and to substitute therefor a second set. This involves disconnections of each roller from its associated spindle and reconnection of the spindle to the neck of the newly inserted roll. The universal couplings, by means of which the spindle ends are connected to the roll necks are, therefore, particularly designed to facilitate this disconnection and reconnection. Changing of the rolls necessitates shutting down of the mill, which is highly undesirable in the case of a plant in full operation for obvious reasons, and it is, therefore, desirable that the rolling mill be so designed that the substitution of one set of rolls for another may be effected in a minimum of time and by a minimum number of operatives.

The present invention contemplates a novel redesign and rearrangement of the conventional members of the rolling mill intended especially to facilitate changing of the rolls when this becomes necessary, so that the time required for this operation is reduced to a minimum and the labor involved also minimized. The achievement of these objects is accomplished by so designing the housing for the gearing or pinions, the connection between the pinions and the power source, the universal couplings, and the spindle supporting means that the spindles, pinions, and pinion housing can be moved toward or away from the mill as a unit, at the will of the operator, in one direction through the distance necessary to effect complete disconnection of the spindles and roll necks and in the reverse direction through the distance necessary to effect complete recoupling of the spindles with the necks of the newly inserted rolls, after a change of rolls has been made.

The pinion housing is preferably slidably mounted upon a stationary base and power driven means provided for effecting the sliding movement of this housing. A novel universal coupling between one of the pinions and the power source permits sliding movement of the pinion housing and pinions toward and away from the driving motor without breaking the driving connection. Furthermore, the universal connections between the spindles and pinions are so designed that these members are inseparable, the spindles at all times following the pinions in their movements. Finally, a novel means is provided for supporting the spindles when disconnected from the mill rolls and by the use of which means the spindle ends are properly presented to the mill roll necks when the spindles are to be again connected. By the cooperation of these various features, the necessary disconnections and connections of the spindles from the rolls, incident to the operation of roll replacement, can be quickly and easily effected.

In the accompanying drawings, one embodiment of the invention is set forth by way of example. It will be appreciated, however, by those skilled in the art, that, in adapting the principles of the invention to rolling mills of different types and constructions, the design and arrangement of the component elements of the invention may be considerably modified without departure from the spirit and scope of the invention.

In the drawings:

Figure 1 is a plan view of a rolling mill and its driving mechanism, to which the invention has been applied;

Figure 2 is a side elevation of the same, parts of the mill and driving mechanism being broken away to show interior details;

Figure 3 is a section on line 3—3 of Figure 1, on a slightly larger scale;

Figure 4 is a section on line 4—4 of Figure 3;

Figure 5 shows in vertical section the journal bearing for the upper spindle;

Figure 6 is a view, partially in side elevation and partially in section, of the universal connection between one of the driving pinions and a motor driven member;

Figure 7 is a section on line 7—7 of Figure 6;

Figure 8 is a section on line 8—8 of Figure 6; and

Figure 9 is a section on line 9—9 of Figure 2.

The rolling mill proper is indicated generally at M in Figures 1 and 2 and the pinion housing at H. The rolling mill itself may be of any conventional design involving a plurality of superposed rollers, and its details of construction need not be described for a full understanding of the present invention. It comprises essentially a frame generally indicated at 10, two rolls indicated at 11 and 12 respectively, and means for vertically adjusting the upper roll 11 in the frame with respect to the lower roll 12. In such vertical adjustments, the cross beam 13 moves with the upper roll and through identical distances.

The pinion housing H lies to one side of the mill proper, being positioned as nearly as possible with the axes of the pinions, which are indicated at 14 and 15 respectively, in the same vertical plane as the axes of the mill rolls 11 and 12. The pinions 14 and 15 may be of conventional type having either spur or helical teeth, as desired, and the pinion necks being suitably mounted in the end walls of the pinion housing. Obviously the pinions rotate in opposite directions when either is driven. Connecting the neck of the upper pinion to the neck of the upper mill roll 11 is a spindle 16, and a second spindle 17 connects the neck of the lower pinion 15 to the neck of the lower roll 12. The other neck of pinion 15 is connected by a novel universal coupling, hereinafter to be described, to a motor driven element 18, which element is connected by any suitable means (not illustrated) to the rotor of an electric motor or, if desired, to some other source of power.

Referring now more particularly to the pinion housing H, it will be seen that this comprises essentially a casing within which the pinions 14 and 15 are enclosed, this casing having a removable cap 20 and also being provided with laterally and horizontally extending flanges 21, 21. The horizontally disposed lower surfaces of these flanges are supported upon horizontally disposed upper surfaces of side pedestals 22, 22 of a stationary base 23 which is fixed upon a suitable foundation. As will be observed upon inspection of Figures 1 and 2 of the drawings, the side pedestals 22, 22 of the base 23 are longer than are the flanges 21, 21 of the pinion housing, and in reality pedestals 22 constitute tracks upon which the flanges 21, 21 may slide, thereby permitting limited movement of the pinion housing as an entirety longitudinally of the base through a limited distance. Each of flanges 21 is apertured at three points to receive vertically extending bolts, the shanks of two of these bolts being indicated at 25, 25 in Figure 3. The bolt heads are indicated at 25' and are seen to be positioned in slots 26 formed in pedestals 22, the shanks of the bolts lying in slots 27 formed in these members and opening into slots 26, and the upper ends of the bolts being provided with nuts 28. The nuts 28 may be tightened to cause the bolts 25 to rigidly clamp the movable pinion housing to its base at any desired point within the length of its travel.

The housing, pinions, and interconnected parts together comprise a relatively heavy mass, and to effect longitudinal movement of the housing upon its supporting base, power means is preferably provided. An electric motor, such as indicated at 30, is a convenient source of power. The rotor of this motor is connected to a shaft 31 extending transversely of the housing and suitably supported in bearings located at one end of the housing. Worms 32 fixed on shaft 31 mesh with worm wheels 33 which are operatively connected to the slidable pinion housing. Various types of connections between the worm wheels and pinion housing may be employed, but in the present instance each worm wheel 33 is keyed or otherwise fixed upon the end of a hollow interiorly threaded shaft 34 rotatably supported in bearings 35 mounted in the frame 23.

Projecting into each hollow shaft 34 is a threaded rod or shaft 36 having one end fixed to the pinion housing, this shaft being exteriorly threaded and these exterior threads meshing with the threads formed upon the interior wall of the associated hollow shaft 34. Shaft 31 is thus operatively connected to the pinion housing at two spaced points by identical means. By rotation of shaft 31 in one direction, rod 36 may be drawn within hollow shaft or sleeve 34 and the pinion housing moved in one direction by equal forces simultaneously applied at spaced points. Reversal of the direction of movement of shaft 31 will result in movement of the pinion housing in the opposite direction, the motor 30 being of the reversible type, so that the pinion housing may be moved in both directions with equal facility. As may be observed from an inspection of Figure 4, the sleeve or hollow shaft 34 is provided with annular flanges or shoulders 34' to resist the strong axial pull or thrust imposed thereon incident to movement of the housing, these flanges being located, respectively, just outside of and resting against bearings 35.

The power driven element 18 is fixed in position, being connected to an electric motor or other prime mover, as has before been explained; that is, it does not move with the housing although it is, of course, free to rotate. The universal connection between the power driven element 18 and the adjacent neck of pinion 15 is clearly illustrated in Figures 6, 7, and 8. Member 18 has secured to it an axially projecting head 40 which is diametrically slotted at 41, thus leaving spaced jaws 42. The adjacent portion of head 43 of the neck of pinion 15 is likewise diametrically slotted so that this member is also provided with spaced jaws. A plate 44, which is substantially rectangular in plan as shown in Figure 8 and which has a thickness very nearly equal to the distances between the opposed inwardly facing parallel surfaces of the jaws, has one end extending between the jaws of member 40 and its opposite end positioned between the jaws of member 43, this plate comprising the coupling plate whereby the rotatory movement of driven head 40 is communicated to head 43 of the pinion neck.

It is essential that plate 44 and the associated heads 40 and 43 be so connected that not only will rotatory movement of head 40 be communicated to head 43 but also that there shall be universal movement between the plate and each of the heads. It is further necessary that this connecting means be so designed that the

heads may approach and recede from each other as the pinion housing is moved by the means previously described. I therefore secure the ends of the plates to the respective heads by universal couplings, such, for instance, as couplings of the type described in my prior Patent No. 1,233,612, granted July 17, 1917, and make provision in one of these connections for lost motion between the plate and head so that the necessary relative axial movement of the two heads may be obtained. Each coupling comprises essentially two half-shoes or slippers of bronze. Each of these shoes has an outer cylindrical surface 46 which rests in a correspondingly formed seat 47 formed in the associated jaw and is provided centrally thereof with an inwardly extending central cylindrical portion 48. The two cylindrical portions 48 of adjacent shoes are coaxial, and in the case of the coupling associated with head 43, these portions project into a transverse centrally located cylindrical opening 49 which passes entirely through the plate 44.

The aligned cylindrical portions 48 of the slippers are likewise provided with central coaxial cylindrical bores 50. Extending through these aligned bores is a bolt 51 of considerably smaller diameter, which bolt secures in position two steel locking plugs 52 positioned within apertures formed in and passing entirely through the opposed jaws of head 43. The inner ends of these locking shoes project into slots 54 cut transversely in the outer portions of the slippers, and the locking plugs serve to prevent axial movement of the slippers relatively to the head while permitting free rocking movement thereof about an axis transverse to the axis of head 43. The diameters of the aligned bores 50 are made considerably greater than the diameter of the bolt 51 in order that the necessary play or rocking movement may be had without causing interference between the walls of these bores and the bolt 51. Naturally the slippers are assembled with the plate 44 as a preliminary operation, and the assembly of plate and slippers is then inserted longitudinally in the aperture between the rounded seats 46, that is, by moving the assembled slippers transversely of the head 43 into the space between the opposed jaws. The locking plugs 52 and bolt 51 are then inserted, and the assembly is complete.

In the case of the coupling associated with head 43 of the pinion neck, there can be no relative axial movement of plate 44 and the pinion neck due to the fact that the inwardly projecting cylindrical portions 48 of the shoes fit closely within the cylindrical recess 49 of the plate. The coupling, by means of which the rotatory movement of the head 40 is communicated to the plate, is identical with that just described except in that the inner cylindrical portions of the shoes do not project within a cylndrical aperture in the plate but, on the other hand, project into a slot indicated at 55. It is, therefore, possible for head 46 to approach head 40, the pin and slot connection between the plate and the coupling slippers of head 40 providing "lost motion" permitting this movement.

The spindles 16 and 17 have their right-hand ends (Figure 2) connected to the pinion necks preferably by universal coupling connections identical with that connecting plate 44 with head 43 so that these spindles and pinion necks have the necessary universal movement relative to each other and at the same time are so tied together that the spindles must move with the pinions when the position of the pinion housing is changed. The opposite or left-hand ends of the spindles, however, are connected to the roll necks by universal connections which permit ready separation of the spindles from the rolls. Various types of universal connections of this character have been heretofore designed, suggested, and put into use, and any suitable type may be employed.

Both spindles are provided with supporting means whereby they are carried when the housing has been moved to cause disconnection of the spindles from the roll necks. For supporting the lower spindle, a stationary bearing, more clearly illustrated in Figure 9, is utilized. This bearing comprises a lower or supporting member 60 which is carried by means, including the springs 61 and bolts 61', upon lugs 62 integral with the base 63, which base is mounted upon a suitable foundation structure 64. Bearing 60 is supplied with a suitable cap 60'. Axial movement of spindle 17, therefore, which results in disconnection of the spindle from the roll 12, causes sliding movement of the spindle relatively to the bearing, and, as soon as disconnection of the spindle and roll is completed, the great bulk of the weight of the spindle is thrown upon the bearing. The spring tension is so regulated, however, that the spindle is supported, when disconnected, at substantially the same elevation that it occupied when connected to the roll so that little difficulty, if any, is had in connecting the spindle to the replacement roll.

The upper spindle 16 is supported centrally by a journal bearing 65 carried by parallel carrier bars 66, one such bar being positioned on either side of the spindle. The journal bearing 65 is provided with opposed horizontally projecting trunnion members 67 which project into suitable notches or recesses formed in the carrier bars. Each such carrier bar is supported at the end adjacent the pinion housing by a vertically disposed suspending rod 68, the lower end of which is pivoted to the end of the carrier bar and the upper end of which is carried upon a spring 69 which rests upon a lug 70 integral with the pinion housing cap. The end of each carrier bar 66 which is positioned adjacent the mill proper is hung by a link 71 pivoted at its upper end to the vertically adjustable cross beam 13. The distance between the points of pivotal connection of the ends of each carrier bar to the respective supporting members is preferably identical with the distance between the transverse axes of the universal couplings by means of which the upper spindle 16 is attached to the associated pinion neck and mill roll neck respectively. This lessens strain on the springs 69 in the operation of the mechanism, insures that there is no excess pressure imposed on the carrier journal bearing 65, and generally promotes smoothness of action of the operating parts.

From the above description, it is believed that the operation of the mill and its driving mechanism will be clearly understood. With the several parts positioned as shown in Figures 1 and 2 of the drawings, the prime mover and the mill rolls are operatively connected, and the mill may operate in the ordinary manner. When it is desired to change the rolls, it is only necessary to stop the prime mover so that the various parts cease to operate and to thereafter cause the motor 30 to rotate in the desired direction. The pinion housing is then retracted, carrying

with it the spindles 16 and 17 which are thereby disconnected from the rolls. The rolls may then be removed and replaced by new rolls, and in the meantime the spindles 16 and 17 are supported with their roll engaging ends ready for reconnection. The motor 30 may then be again energized and in the reverse direction to cause movement of the pinion housing and of the spindles toward the newly inserted roll, the connection between the spindle ends and the rolls being easily effected. The whole operation of changing rolls is greatly facilitated, it being possible, by means of the mechanism just described, to effect the disconnection and reconnection of the driving means to the mill rolls in a minimum time and with minimum expenditure of labor.

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

1. In a rolling mill, in combination, a roll stand provided with removable cooperating rolls, relatively stationary driving means for said rolls, driving transmission means disposed between said roll stand and said driving means, said transmission means comprising a horizontally shiftable pinion housing, a plurality of pinions in said housing arranged in fixed intermeshing relation with each other, an extensible universal coupling between one of said pinions and said driving means, a spindle adapted to operatively connect each of said pinions with one of said rolls, fixed universal couplings between said pinions and said spindles, detachable universal couplings between said spindles and said rolls, supporting means for certain of said spindles for causing them to incline during adjustment of the rolls to which they may be connected in order to continually maintain the alignment of the adjacent ends of said spindles with said rolls.

2. In a rolling mill, in combination, a roll stand provided with removable cooperating rolls, a relatively stationary roll driving shaft, transmission means disposed between said roll stand and said driving shaft, said transmission means comprising a horizontally shiftable pinion housing, a plurality of pinions in said housing arranged in fixed intermeshing relation with each other, an extensible universal coupling between one of said pinions and said driving shaft, a spindle adapted to operatively connect each of said pinions with one of said rolls, fixed universal couplings between said pinions and said spindles, detachable universal couplings between said spindles and said rolls, power means for shifting said pinion housing and consequently said spindles toward and from said roll stand and said driving shaft respectively, whereby the rolls may be readily removed without shifting said roll stand, means for supporting certain of said spindles from said roll stand and said pinion housing for causing them to incline during adjustment of the rolls to which they may be connected in order to continually maintain the alignment of the adjacent ends of said spindles with said rolls.

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