Jan. 3, 1933. A. KUHNS 1,893,290

ROLLING MILL

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Fig. 1.

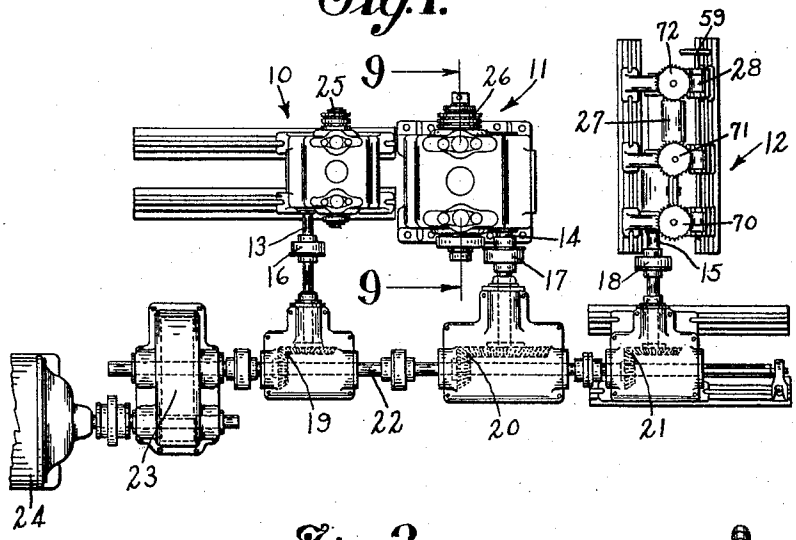
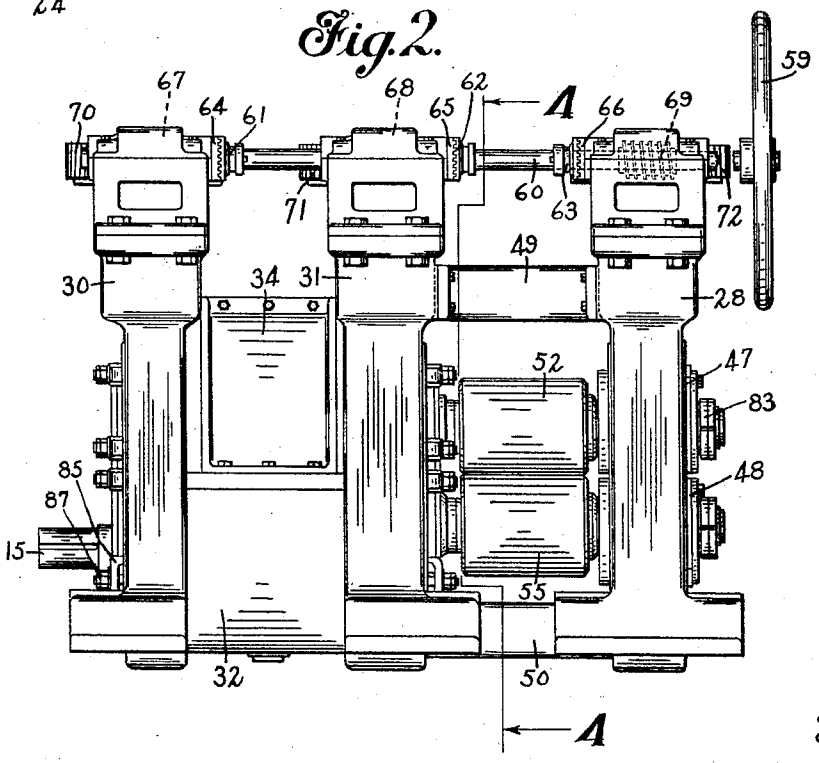


Fig. 2.



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Fig. 3.

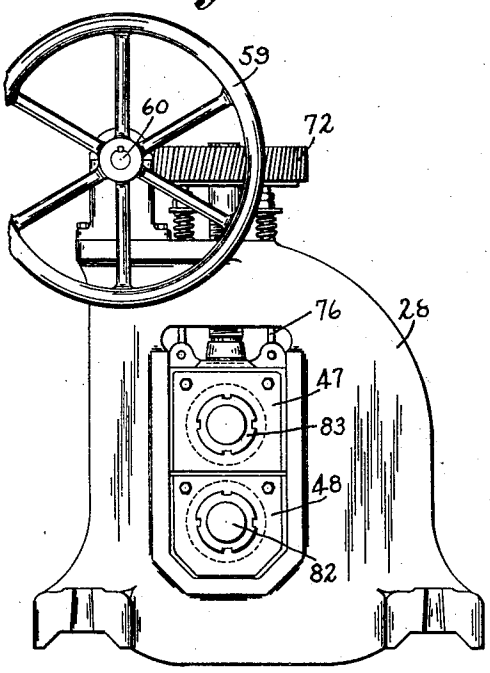


Fig. 4.

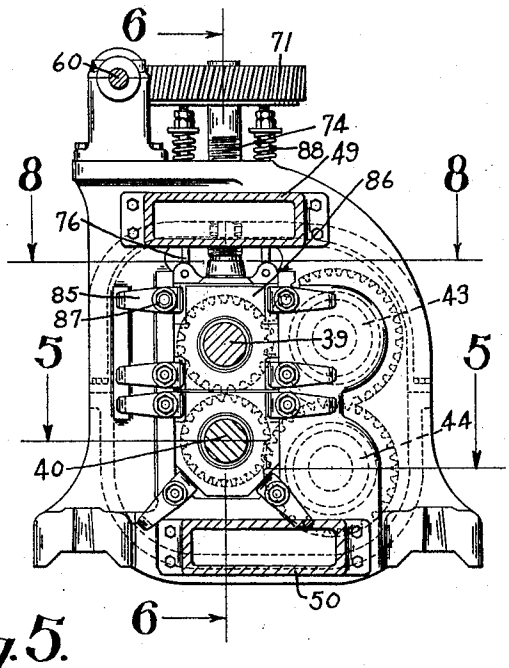
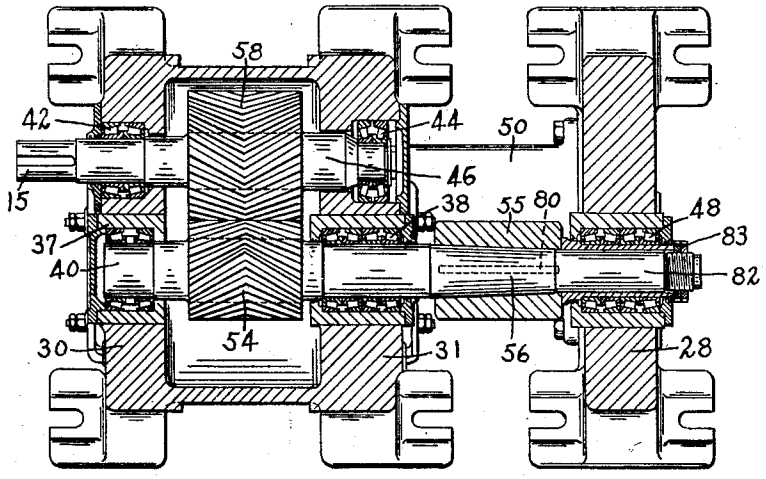


Fig. 5.



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ROLLING MILL

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Fig. 6.

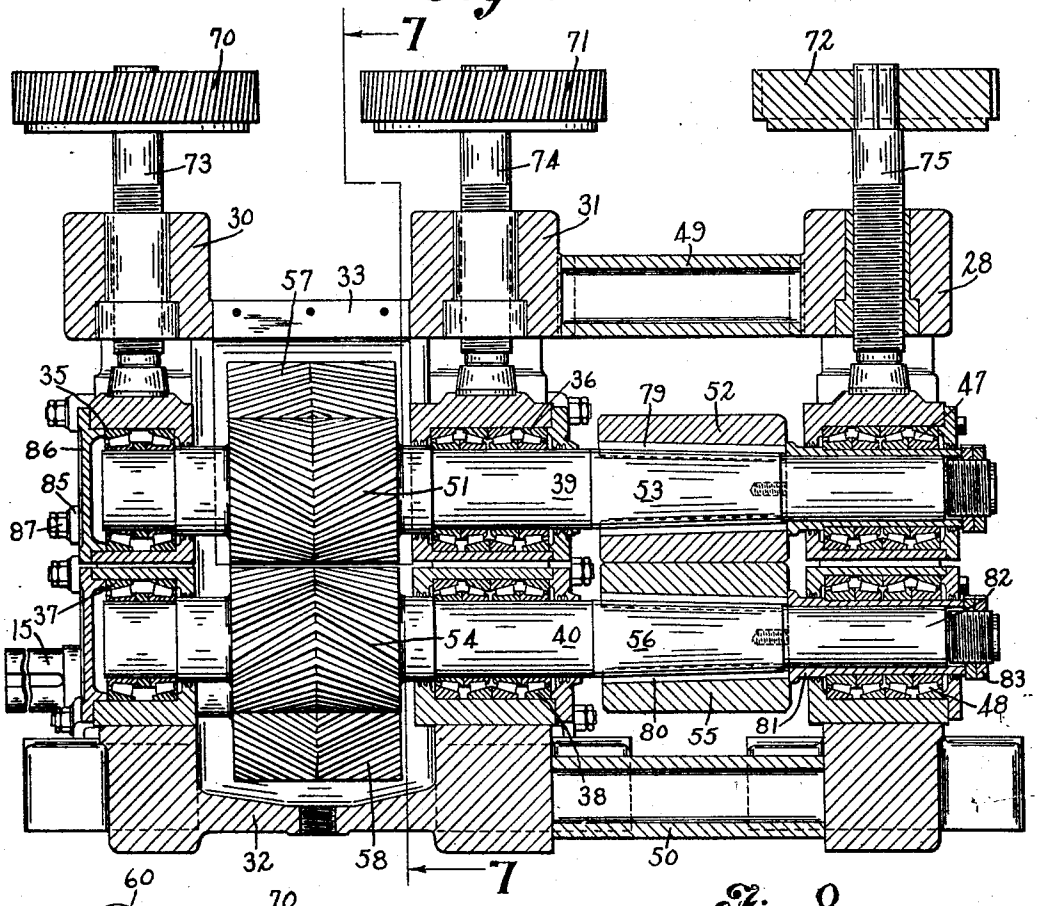


Fig. 7.

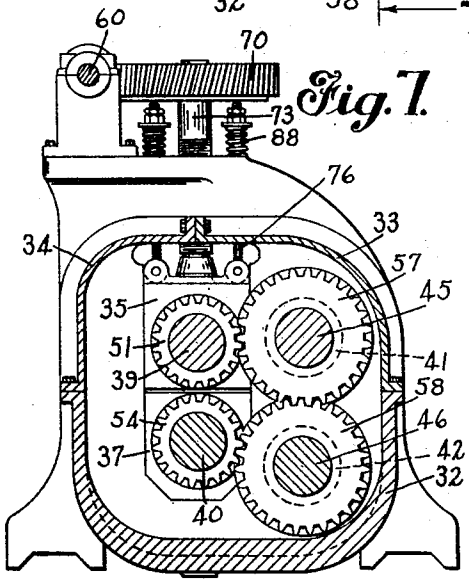
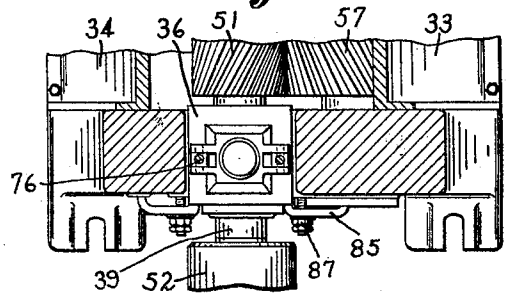


Fig. 8.



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ROLLING MILL

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Fig. 9.

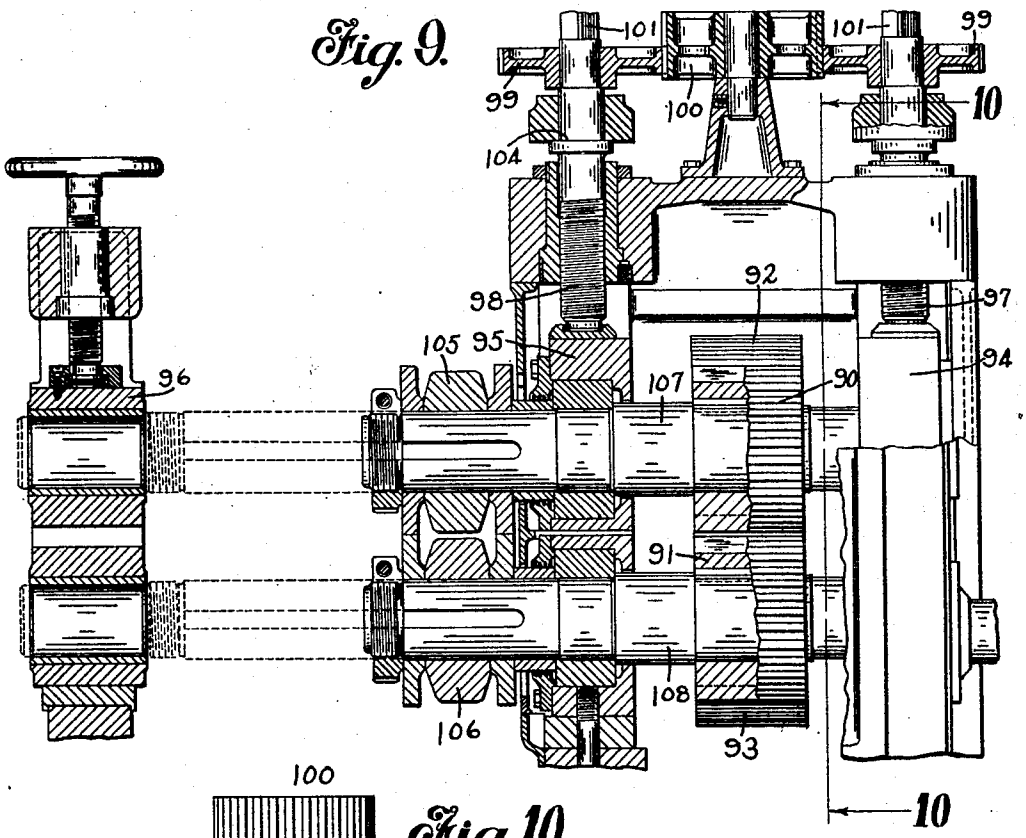
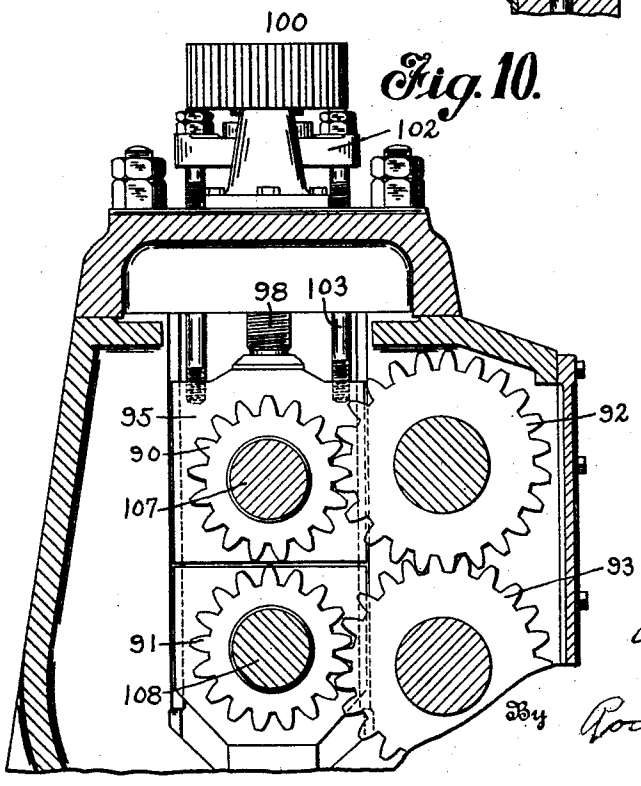


Fig. 10.



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UNITED STATES PATENT OFFICE

AUSTIN KUHNS, OF BUFFALO, NEW YORK, ASSIGNOR TO FARREL-BIRMINGHAM COMPANY, INC., OF BUFFALO, NEW YORK

ROLLING MILL

Application filed October 5, 1929. Serial No. 397,532.

This invention relates to rolling mills, and more particularly to improvements in pinion and roll-stands for metal rolling mills.

Generally, the pinion and roll stands of rolling mills are separate units and require connecting means therebetween. This combined mechanism was relatively expensive to make and covered considerable floor space, a valuable item to present day manufactures. The bearings of the roll stands of such machines were movable so as to allow for difference in diameter between various pairs of rolls used with the same, or in order to alter the center to center distance therebetween. When the rolls were separated, a misalignment between their axes and the axes of their driving pinions was caused. As the bearings of the driving pinions were not adjustable it was necessary to provide some means for taking care of this misalignment, and the means generally used was an arrangement of coupling boxes and a connection between the coupling boxes known as wabblers. Such a connection was necessarily a loose one, and and considerable loss in the efficiency of the machine was experienced.

The improvement in rolling mills of this invention generally provides a combined pinion and roll-stand, from which the coupling boxes, wabblers and other parts have been eliminated. By the use of the improved mechanism of this invention, a more even and uniform rolling will be obtained than has heretofore been possible. An additional feature has been provided permitting a wider variation between the centers of the rolls without impairing the efficiency of the mill.

One of the objects of this invention is to provide improvements in rolling mills or the like, whereby the efficiency thereof will be increased and the cost of making, installing and operating the same will be decreased.

Another object of the invention is to provide in a rolling mill an improved pinion and roll-stand.

Still another object of this invention is to provide a rolling mill with a novel form of combined pinion and roll-stand, by the use of which the efficiency of the rolling mill will be increased.

A further object of this invention is to provide a combined pinion and roll stand for a rolling mill or the like, and wherein means is provided to permit a wide variation in roll center distance, without inconvenience and without impairing the efficiency of the mill.

Still further objects of this invention are to provide a combined pinion and roll-stand which will occupy less floor space than has heretofore been possible, means to individually adjust the bearings of the pinions and rolls to align the same, and to generally improve the structure thereof, whereby fewer parts may be required, roller bearings may be used, the parts will be more readily accessible for repair or changeover, and other advantageous features will be obtained.

To these and other ends, the invention consists in the novel features and combinations of parts to be hereinafter described and claimed.

In the accompanying drawings:

Fig. 1 is a plan view of the rolling mill embodying the features of this invention, and comprising three sets of pinion and roll-stands;

Fig. 2 is a view of the discharge end of a combined pinion and roll-stand, embodying the features of this invention;

Fig. 3 is an end view of the machine shown in Fig. 2;

Fig. 4 is a section on line 4—4 of Fig. 2;

Fig. 5 is a section on line 5—5 of Fig. 4;

Fig. 6 is an enlarged section on line 6—6 of Fig. 4;

Fig. 7 is a section on line 7—7 of Fig. 6, slightly reduced in scale;

Fig. 8 is a partial section on line 8—8 of Fig. 4;

Fig. 9 is a slightly modified form of pinion and roll-stand, and is a partial section on line 9—9 of Fig. 1, and

Fig. 10 is a section on line 10—10 of Fig. 9.

The rolling mill illustrated in Fig. 1 is one which is adapted for the purpose of rolling material of a special nature, and will be described only generally with especial reference to the novel features of this invention embodied therein. This rolling mill generally comprises a plurality of sets of com-

bined pinion and roll stands 10, 11 and 12, the driving shafts 13, 14 and 15 of which respectively are connected by couplings 16, 17 and 18, and sets of bevel gears 19, 20 and 21, with a main drive shaft 22. The shaft 22 is driven, in this instance, through a reduction gear 23 by an electric motor 24. Work is fed to the entry rolls 25, passed through the slitting or forming rolls 26, then between and out of the delivery rolls 27.

The sets of stands 10, 11 and 12 are similar to each other in respect to many of the features of this invention and, therefore, as to these features, the description of one of these stands will suffice. Figs. 2 to 8 inclusive, illustrate in detail the pinion and roll stand 12, which, in this instance, supports the delivery rolls and the driving pinions and gears therefor. This stand differs from the others (10 and 11) in that it is provided with means to adjust the bearings of the pinions and rolls, both individually and in unison, and that the rolls are provided with a detachable outboard bearing stand 28, the rolls 27 requiring such, due to their length in this instance. Figs. 9 and 10 generally illustrate the construction of stand 11, but as shown in Figs. 9 and 10, it has been slightly modified to illustrate slight modifications which it is possible to make in the same to adapt it for other work.

Referring to Figs. 2 to 8 inclusive, the combined pinion and roll-stand 12 comprises a supporting frame having side members or housings 30 and 31. The side members 30 and 31 are joined together at their lower portions by a trough-like member 32, which forms the bottom of a gear casing and in which a sufficient amount of oil may be retained for lubricating purposes. As shown in Fig. 7, the member 32 is U-shaped in cross-section. Cover plates 33 and 34 are bolted to the member 32 and extend over the same as a cover therefor.

Each of the side members 30 and 31 is adapted to slidably support respectively upper bearings 35 and 36, and lower bearings 37 and 38, in which are journaled respectively upper and lower pinion and roll shafts 39 and 40. To the rear of the bearings 35 and 36, and 37 and 38, upper and lower bearings 41 and 42, and 43 and 44 respectively, are disposed in the side members 30 and 31, and upper and lower back gear shafts 45 and 46 respectively are journaled therein. In this instance, the drive shaft 15 is a continuation of the back gear shaft 46.

The pinion and roll shafts 39 and 40 are extended considerably beyond the side member 31, and are respectively journaled in bearings 47 and 48, slidably supported in the outboard frame 28. The frame 28 is detachably secured to the side member 31 by bolting or otherwise fastening it to upper and lower spacing blocks 49 and 50 respectively, which in turn are bolted or otherwise fastened to the member 31.

A pinion 51 is secured to or formed integral with the shaft 39, and is disposed thereon between the side members 30 and 31. A roll 52 is secured to a tapered portion 53 of the shaft 39, and is disposed thereon between the side member 31 and the frame 28. A pinion 54 is secured to or formed integral with the shaft 40 and is disposed thereon between the side members 30 and 31. A roll 55 is secured to a tapered portion 56 of the shaft 40, and is disposed thereon between the side member 31 and the frame 28. The arrangement of the pinion and roll bearings is such that the pinions 51 and 54 are never permitted to mesh even though the rolls 52 and 55 are in contact.

Back gears 57 and 58 are respectively secured to or formed integral with shafts 45 and 46. The back gears 57 and 58 mesh with each other and with pinions 51 and 54 respectively. The rotation of gear 58 will, therefore, cause the rotation of the pinions 51 and 54, and the rolls 52 and 55 in opposite directions so as to draw in the work being rolled thereby. Both the back gears 57 and 58, and pinions 51 and 54 preferably have double helical or herring-bone teeth cut thereon.

All of the upper bearings 35, 36 and 47 are adapted to be moved vertically in their respective supports by means of a hand wheel 59. The hand wheel 59 is secured to a shaft 60, which has serrated clutch members 61, 62 and 63 secured thereto and disposed in engageable relation with corresponding clutch members 64, 65 and 66 respectively. The clutch members 64, 65 and 66 are respectively secured to worms 67, 68 and 69, which respectively mesh with worm wheels 70, 71 and 72.

The worm wheels 70, 71 and 72 are respectively secured to threaded studs 73, 74 and 75, which extend downwardly through the side members 30 and 31 and the outboard frame 28 respectively. The lower ends of each of the studs 73, 74 and 75 engage the bearings 35, 36 and 47 respectively, so that when properly rotated they will force down or lower said bearings against the upward urge of springs 88, which by means of rods 76 are connected to each bearing for this purpose. By providing the clutches for each worm, the bearings may be individually adjusted without disturbing the setting of the remaining ones, and a perfect alignment thereof obtained whereby efficient roller bearings, such as the type shown, may be provided.

The tapered portions 53 and 56 of shafts 39 and 40 upon which rolls 52 and 55 are respectively mounted, are arranged so that the smaller diameter of each is adjacent the frame 28. The bearings 47 and 48 are adapt-

ed to be removed from the frame 28 so as to permit the rolls 52 and 55 to be removed from the machine in an axial direction with respect to the shafts 39 and 40. The rolls 52 and 55 are secured to their respective shafts by keys 79 and 80 respectively, and by an axially slidable sleeve 81, disposed upon a portion 82 of each shaft, which is journaled in the bearings 47 and 48. The ends of the shafts 39 and 40 without the frame 28 are threaded, and threaded collars 83 engaged therewith may be operated to slide the sleeves 81 toward the rolls, which in turn, are each forced upon their respective tapered shaft portions. By removing the collars 83 and raising the adjusting screw or stud 75, either bearing 47 or 48 with the corresponding sleeve 81 and roll 52 or 55, may be axially removed.

The bearings 35 and 36, and 37 and 38 supported respectively by the side members 30 and 31, may also be axially removed to permit the axial removal of the pinion shafts 39 and 40, when it is desired to do so. Each of these bearings is retained in position by a purality of clamp members 85 disposed about the end plate 86 of each bearing and operated by clamp bolts 87.

The embodiment shown in Figs. 9 and 10, differs somewhat from the previously described form. The pinions 90 and 91, and back gears 92 and 93, have straight teeth instead of herring-bone or double helical teeth. The upper pinion bearings 94 and 95 are directly connected for vertical adjustment, and the outboard frame bearing 96 has a separate adjustment. The threaded studs 97 and 98 are each provided with a gear 99 which is secured upon its upper end. Both of the gears 99 mesh with an intermediate gear 100. Rotation of either stud 97 or 98 by means of a wrench or the like applied to a squared end 101 of each will rotate the other gear. Any rotation of the studs 97 or 98 will raise or lower the bearings 94 and 95. The bearings 94 and 95 are raised by the engagement of yokes 102, one of which is connected to each of the bearings by means of rods 103, with a shoulder 104 formed on each of the studs 97 and 98. The bearings 94 and 95 are lowered by the engagement of the lower end of each stud 97 and 98, with the upper surface of each respective bearing.

Figs. 9 and 10 illustrate the use of a pinion stand of this invention in instances where an outboard frame is not required, the rolls 105 and 106 being secured to the outer ends of the pinion shafts 107 and 108 respectively. It is obvious that such an arrangement is possible for the form shown in Figs. 2 to 8 inclusive, the outboard frame 28 of which may readily be detached from the side member 31.

By providing a rolling mill with the above described novel features and structures, the floor space required for the same is materially reduced in comparison with the amount of floor space generally required for a rolling mill of the same capacity, this reduction amounting to at least 40% in some instances. Loose spindles, wabblers and coupling boxes are eliminated and the action of the respective units of the mill is, therefore, much smoother and the rolled material more uniform in thickness, due partly to the elimination of all vibration caused by loose connections. A machine such as above described, costs substantially less to build, and due to the individual adjustment provided for each bearing, whereby perfect alignment thereof may be obtained when two or three bearings are used in line, roller bearings may be provided to further increase the efficiency of the machine.

Due to the novel arrangement of the pinions and back gears, a wider variation between the roll centers is permitted than has heretofore been practical, and this enlargement in the scope of the mill is accomplished without impairing the efficiency of the mill. One way by which this variation is possible, is by providing back gears which are of greater diameter than the pinions whereby the distance between the centers of the back gears is greater than the distance between the centers of the pinions when the pinions are disposed as close to each other as is possible without their engaging. The pinions may then be separated by vertical movement of their bearings to and beyond the back gear centers into a position whereby the distance between the centers of the pinions is greater than that between the centers of the back gears. As the movement of the pinions is also transmitted to the rolls, these are separated an equal amount. A difference of five inches between different adjustments of roll centers has been obtained without causing a back-lash between the teeth of the pinions and the back gears of more than .025 of an inch. In actual practice a difference of 2″ between centers is generally sufficient. In both instances the operating efficiency of the machine has been found to be the same.

In the construction herein described it will be understood that the lower roll is adjustable vertically as well as the upper roll, and after adjustment can be held in the adjusted position by any desired means. The pinion of this roll is adjustable relatively to the larger back gear or driving pinion meshing therewith in the same way that the pinion of the upper roll is adjustable relatively to the upper back gear. The shafts of the back gears are fixedly mounted in large bearings in the housing itself so that the back gears are very firmly supported at all times and the load properly carried regardless of the direction of rotation of the gears and pinions. Therefore a large amount of power can be transmitted as required for driving

rolls operated on heavy work. In all the various adjustments the drive is very satisfactory and efficient notwithstanding the fact that the back gears rotate on fixed centers and the fact that the bearings for the roll spindles in each housing are accommodated in a single vertically disposed window machined in the housing. The design is such that very satisfactory results are obtained by adjusting one or both of the roll spindles substantially rectilinearly instead of along an arc or arcs drawn from the centers of the back gears, and the construction as a whole is simple, compact and rugged and has considerably increased the usefulness of such mills in actual practice. The adjustability of the lower roll is, of course, more easily provided for by reason of the fact that said roll is driven from the corresponding back gear in the manner described, and for other reasons, also, the driving of the mechanism by applying power to one of the back gears is more satisfactory than other arrangements.

While I have shown and described a preferred embodiment of my invention, it is understood that it is not to be limited to all of the details shown, but is capable of modification and variation which will lie within the spirit of the invention and the scope of the appended claims.

What I claim is:

1. In a rolling mill having upper and lower rolls which are vertically adjustable without disengaging them from their driving mechanism, the combination of a stand, a pair of permanently interengaging back gears mounted in said stand at one side thereof and having fixed bearings in the stand, one of said gears being located above the other, means for driving one of said gears, combined roll and pinion shafts mounted in said stand at one side of said back gears, pinions on the respective shafts meshing with the respective gears and driven therefrom, means whereby said pinions are adjustable vertically in a straight line within certain limits without interrupting their driving engagement with said gears, said back gears operating to revolve said pinions irrespective of variation in the center-to-center distances of the pinions and gears within certain limits, and rolls on said combined pinion and roll shafts.

2. In a rolling mill having upper and lower rolls which are vertically adjustable without disengaging them from their driving mechanism, the combination of a stand, a pair of permanently interengaging back gears mounted in said stand at one side thereof and having fixed bearings in the stand, one of said gears being located above the other, means for driving the lower gear, combined roll and pinion shafts mounted in said stand at one side of said back gears, both of which shafts are adapted to be adjusted vertically, pinions on the respective shafts of less diameter than said back gears, meshing with the respective gears and driven therefrom, means whereby said pinions are adjustable in a straight line within certain limits without interrupting their driving engagement with said gears, said back gears operating to revolve said pinions irrespective of variation in the center-to-center distances of the pinions and gears within certain limits, and rolls on said combined pinion and roll shafts.

3. In a rolling mill, the combination of a stand, a pair of roll shafts mounted in said stand one above the other, rolls on said shafts, pinions on said shafts, back gears intermeshing with each other and meshing with the respective pinions, one of said back gears being located above the other, a fixed bearing for the upper back gear in said stand, said upper back gear being of larger diameter than the upper pinion, means whereby said upper pinion is adjustable in a straight line so as to vary its center-to-center distance with respect to the upper back gear without disturbing the drive from the upper back gear to said pinion, and means for rotating said back gears in order to drive the rolls.

4. In a rolling mill, a stand, a pair of roll shafts in said stand one above the other, rolls on said shafts, pinions on said shafts, a back gear meshing with the upper pinion, a fixed bearing for said back gear in said stand which prevents lateral movement of said gear and holds the same stationary in said stand, said upper pinion being of less diameter than said upper back gear, means whereby said upper pinion is adjustable tangentially with respect to said upper back gear within certain limits while maintaining the driving engagement of said upper back gear with said pinion, and a lower back gear which drives the upper back gear and likewise the lower pinion.

5. A pinion and roll-stand, comprising a pair of side members, shafts journaled in said side members, a pinion on each shaft and disposed between said side members, intermeshing gears disposed between said side members, each of said gears meshing with one of said pinions, means to drive said gears, an outboard bearing frame detachably secured to one of said side members and having bearings therein for said shafts, cooperating rolls secured one on each of said shafts and disposed between said outboard frame and the side member to which said frame is secured.

6. A pinion and roll-stand, comprising a pair of side members, shafts journaled in said side members, a pinion on each shaft and disposed between said side members, intermeshing gears disposed between said side members, each of said gears meshing with one of said pinions, means to drive said gears, an outboard bearing frame detachably secured

to one of said side members and having bearings therein for said shafts, cooperating rolls secured one on each of said shafts and disposed between said outboard frame and the side members to which said frame is secured, and means to vary the center to center distance between said rolls.

7. A pinion and roll-stand, comprising a pair of side members, parallel shafts journaled in bearings in said side members, a pinion on each shaft and disposed between said side members, intermeshing gears disposed between said side members, each of said gears meshing with one of said pinions, means to drive said gears, an outboard bearing frame detachably secured to one of said side members and having bearings therein for said shafts, cooperating rolls secured one on each of said shafts and disposed between said outboard frame and the side member to which said frame is secured, and means to raise and lower the bearings of one of said shafts both individually and in synchronism.

In witness whereof, I have hereunto set my hand this 3 day of October, 1929.

AUSTIN KUHNS.