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ROLLING MILL

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Fig. 3

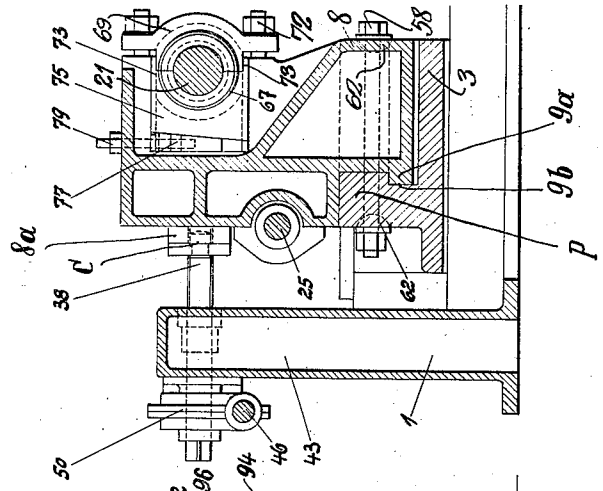
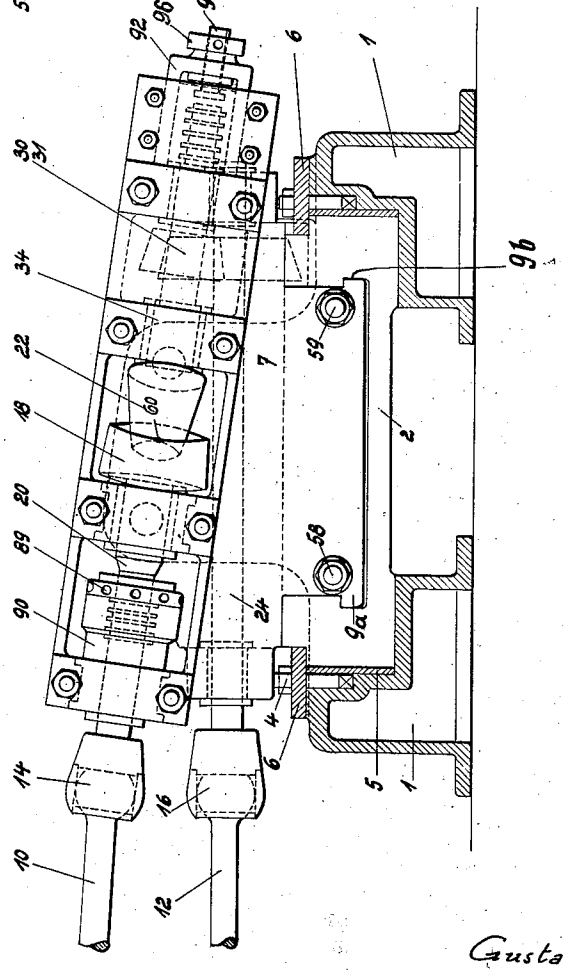


Fig. 1



Gustav Asbeck

by C. F. Goepel

his Attorney.

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ROLLING MILL

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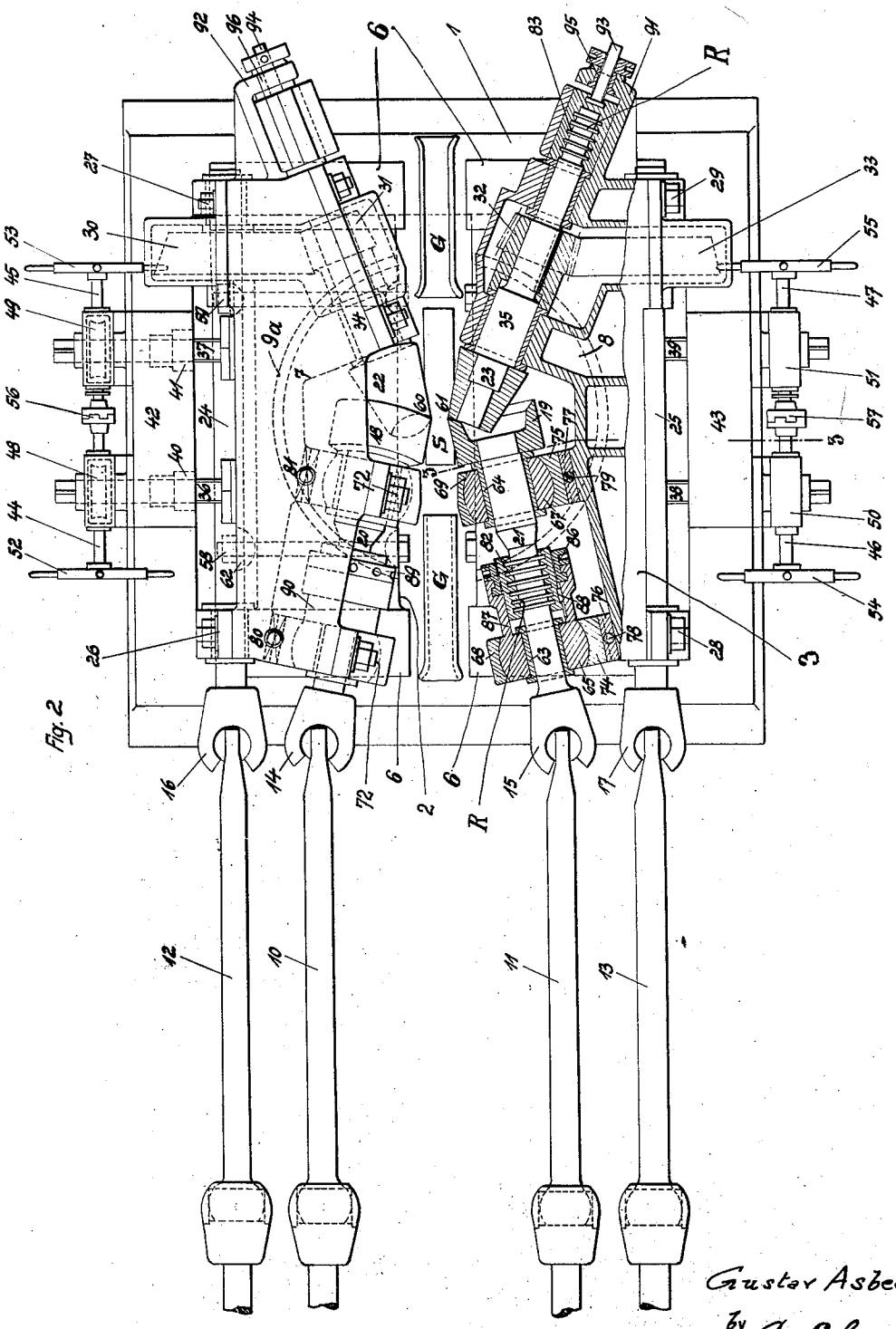


Fig. 2

Gustav Asbeck
by C. F. Goepel
his Attorney.

Patented Apr. 8, 1930 1,753,767

UNITED STATES PATENT OFFICE

GUSTAV ASBECK, OF DUSSELDORF-RATH, GERMANY

ROLLING MILL

Application filed March 1, 1928, Serial No. 258,218, and in Germany April 12, 1927.

The invention relates to improvements in rolling mills, especially rolling mills for manufacturing seamless pipe and other tubular products.

An object of the invention is to provide a rolling mill in which the rolls can be easily assembled, and very effectively adjusted; to compensate for wear and to enable the rolls to be maintained in the best operative condition.

In rolling mills of the type for which my invention is intended there are usually two pairs of rolls, one pair serving as feed rolls and the other pair as discharge rolls. The stock or material to be worked passes first between the feed rolls and then between the discharge rolls; and adjustment of the rolls is needed as the rolls become worn. The wearing of the rolls requires turning down or grinding off the rolls, with the result that the circumferential speed of the rolls changes and between the two adjacent rolls a difference of speed may exist. Hence a tearing of the material to be worked may ensue.

Of course all risk of tearing should be obviated; and by properly adjusting the adjacent rolls after same have been turned and ground, I can obtain in the practice of my invention a rotation of the rolls of uniform speed; so that no tearing or other damage of the stock or material can take place. Eventually the two discharge rolls, which enter the feeding rolls, will become so turned off on their front ends that the feeding and discharge rolls at their meeting ends will possess the same peripheral velocity.

The construction is such that adjustment can be made of each side of the stock either by moving or displacing one or both rolls laterally; or simply by moving one roll axially.

Further, in rolling mills of this general type, the discharge roll has usually been mounted to operate to some extent within the feed roll. Therefore, during the erection of such a rolling mill, or replacing of the rolls, it is necessary to lift both rolls at the same time; and two cranes have always to be employed. With a rolling mill according to this invention, however, only one crane is needed, because the discharge roll is only disengaged from the adjacent feed roll and the rolls can thus be handled one at a time, when the rolling mill is erected and installed.

Further objects and advantages of this invention will be set forth in the following description, taken with the accompanying drawings, in which an embodiment of the invention is illustrated, but the disclosure is explanatory only, and I may change the shape and size and arrangement of the various parts without departing from the principle of the invention or exceeding the scope of the appended claims.

On the drawing, Figure 1, there is a sectional view taken horizontally through the middle of the machine as it is shown in Figure 2.

Figure 2 is a plan view partly in section of the entire rolling mill, part of it being in section on the level of the axis of the rollers on one side; and

Figure 3 is a transverse section of part of the rolling mill taken on the line 3—3 of Figure 2.

The mill consists of a supporting framework 1, in which are mounted the slidable bases 2 and 3, one on each side of the framework as indicated in Figure 2. These bases 2 and 3 can be moved or adjusted towards and from each other; and each supports one of the feed rolls and one of the discharge rolls, together with the shafts for operating these rolls. Between the two bases, 2 and 3 and somewhat above the level thereof will be the material to be worked indicated by the letter "S" in Figure 2. The frame 1 is shaped to receive the bases 2 and 3 and mount them in proper position, as indicated in Figures 1 and 2, to allow them to be moved as required. At each end and between these bases 2 and 3 and adjacent parts of frame 1, wear plates 5 are inserted and the bases 2 and 3 are held down in the framework 1 by means of cover plates 6 secured to the framework 1 by bolts 4. These plates 6 project over shoulders on the bases so that the bases cannot move upwards with respect to frame 1.

The base 2 supports in a rotatable manner a mount in the form of casting or body 7; and the base 3 supports in the same fashion a

similar mount 8. Each of these castings carries one of the feed rolls and one of the discharge rolls, together with means for operating the rolls which will be hereafter explained. The bottoms of the castings 7 and 8 are semi-circular as indicated by the broken lines in Figure 2 and the circular edges of these bottoms will each have a projecting rib 9^a to enter a semi-circular groove 9^b, one of which is formed in each of bases 2 and 3. Thus these castings can be turned on their lower ends after the manner of turrets to change the direction of the axes of the feed and discharge rolls.

The rolls mounted upon the turrets or members 7 and 8 are rotated by the driving shafts 10, 11, 12 and 13, one of which is connected with each of the rolls through universal joints 14, 15, 16 and 17 respectively. The shafts or spindles 10 and 11 are connected with the feed rolls 18 and 19, one of which is mounted on each of the turrets 7 and 8, through shafts 20 and 21. The discharge rolls 22 and 23 each co-operate with the rolls 18 and 19 respectively and are mounted on the same members 7 and 8 and driven from the shafts 12 and 13 through counter shafts 24 and 25 disposed in bearings on turrets 7 and 8. These counter shafts 24 and 25 extend from one end of the castings to the other substantially parallel to the adjacent sides of bases 2 and 3. The counter shaft 24 of the casting 7 is supported in bearings 26 and 27 and the other counter shaft of the turret 8 is supported in bearings 28 and 29. These two shafts have mounted thereon to turn gear wheels 30 and 33 respectively, which engage gear wheels 31 and 32 respectively, affixed to shafts 34 and 35 respectively on which the discharge rolls 22 and 23 are respectively mounted. As shown in Figure 2, rolls 18 and 19 may be cup-shaped and the rolls 22 and 23 are conical and so disposed with respect to the adjacent feed rolls that the surfaces of the rolls 18 and 19 may substantially meet those of the rolls 22 and 23 at the points where they engage the stock "S".

On each end of the machine the frame may carry tubular guides G in line with the stock S. This stock may be hollow or solid; and if solid it will be engaged by a mandrel to pierce it in the direction of its axis as it is worked by the rolls 18, 19, 22 and 23 to make a pipe or tubing out of it.

To adjust the rolls on each side of the stock S to increase or decrease the caliber of the mill, the members 7 and 8 are actuated to cause the bases to slide towards or from each oher without turning the turrets on their bottoms on the bases 2 and 3. For this purpose I provide spindles 36 and 37 for the turret 7 and similar spindles 38 and 39 for turret 8. These spindles may pass through speed nuts or bearings 40 and 41 in the framework 1, being mounted in fact upon uprights 42 and 43 of the framework. These spindles may be operated by shafts 44, 45, 46 and 47 respectively by means of worms on these shafts engaging worm gears 48, 49, 50 and 51 respectively on these spindles. Further, on the control shafts are hand wheels 52, 53, 54 and 55 respectively; and these control shafts on each side of the main frame are connected by releasable clutches 56 and 57. Therefore, if the rolls on the two sides of the stock S are simply to be brought closer together or removed further apart, the control shafts 44 to 47 inclusive, are moved all together to operate the members 7 and 8 and move the bases 2 and 3 accordingly. The spindles 36 to 39 inclusive are mounted at the same level as the shafts for turning the rolls. On their inner ends they may have collars "C" to engage shouldered bearings, one of which is indicated at 8A carried by the members 7 and 8. Thus turning the spindles in unison will push the bases 2 and 3 and members 7 and 8 towards each other, or pull the same apart.

In case it is desired to change the angle between the axes of the discharge rolls on each side, the clutches 56 and 57 are released and then the control shafts 44 to 47 are rotated independently. For example, if the hand wheels 52 and 53 are turned in opposite directions, one of the spindles 36 will pull upon the turret 7 and the other 37 will push upon it to swing it about the axis passing through the center of curvature of the rib 9^a. The axes for the turrets 7 and 8 are indicated by the numerals 60 and 61 in Figure 2. Before this can be done, however, bolts 58 and 59, which pass through the bottoms of turrets 7 and 8 and through vertical projections P on the bases 2 and 3, and carry nuts to enable the bolts to bind the castings 7 and 8 and bases 2 and 3 together, must be loosened to allow some rotating movement to the turrets 7 and 8. The openings for these bolts through the vertical projections P on the bases 2 and 3 which are indicated in Figure 3 for example, may be enlarged somewhat and spherical washers 62 may be provided under the nuts on the ends of the bolts to be passed through these vertical projections P to enable the bolts to hold in any position to which the turrets 7 and 8 may be adjusted.

Thus the turrets 7 and 8 can both be swung around vertical axes to be adjusted, or they can be moved separately straight towards each other or apart from each other by actuating the sliding bases 2 and 3.

I also provide for adjusting the rolls 18, 19, 22 and 23 separately in the members 7 and 8 by suitable means which acts in combination with shafts 20, 21, 34 and 35. The shafts 20 and 21 are to be mounted in sleeves 63 and 64 at their opposite ends. These

sleeves are disposed in spherical bearings 65 and 67, each of which may consist of two halves for convenience in putting them over the sleeves 63 and 64, and secured by retainers 68 and 69, affixed to the turrets 7 and 8 by screws 72. The bearings 65 and 67 are each provided with flats 73 to enable them to be slipped into recesses in the members 7 and 8, and between these bearings and the inner ends of these recesses are concave blocks 74 and 75 which fit the bearings and are engaged by wedges 76 and 77, the wedges for the roll 19 being adjusted by the screws 78 and 79. The wedges for the roll 18 are adjusted by the similar screws 80 and 81. As indicated in Figure 3 when these wedges move downward, the blocks 74 and 75 together with the sectional bearings 65 and 67 are moved in the direction of the adjacent guide G. If one wedge is moved more than the other a change in the direction of the shaft 21 results, but the shaft 21 continues to be free to rotate because of the effect of the spherical bearings 65 and 67. Thus if desired any angular position of the shafts 20 and 21 can be secured. The turning of the turrets 7 and 8 swings the shafts 34 and 35 into position; and further adjustments of the shafts 20 and 21 is thus also afforded by the screws 78 to 81 and wedges 76 and 77.

It is further necessary to be able to adjust shafts 20 and 21, 34 and 35 to displace the rolls separately in an axial direction. I therefore provide a thrust bearing 82 for each of the shafts 20 and 21 and another thrust bearing 82 for each of the shafts 34 and 35. The bearing 82 for the shaft 21 is in a sleeve 87 attached to bearing 65 and enveloping the shaft and a similar sleeve 90 carries the corresponding bushing 83 enveloping the shaft 20. In each of these sleeves, or extensions 87 and 90 is a nut 86 which has screw threaded engagement with the outside of the thrust bearing 82. This thrust bearing is prevented from turning in the sleeve 87, likewise in the sleeve 90, by means of a projection 88 engaging a key wall or groove inside of this sleeve.

The nuts 86 may have holes 89 to be engaged by spanner or other tool so that when these nuts are turned, the thrust bearings 82 will move the shafts 20 and 21 forward or backward in the sleeves 87 and 90. The shafts 20 and 21 will have peripheral ribs R fitting inside grooves in the bearings 82, so that the axial movement of the bearings 82 will move the shafts longitudinally, while the shafts can rotate freely in these bearings 82.

To adjust the rolls 22 and 23 in the direction of their axes of rotation, the turrets 7 and 8 have brackets 91 and 92 respectively and the thrust bearings 83 have threaded projecting stems 93 and 94 passing through the brackets 91 and 92. The stems 93 and 94 are affixed to the thrust bearings 83. The stems are threaded and in the brackets 91 and 92 are internally threaded sleeves 95, and 96 respectively. These sleeves each have a collar at one end and a head at the other. When the heads are turned the sleeves act like nuts on the stems 93 and 94 to shift the bearings 83. The bearings 83, like the bearings 82, cannot turn in the brackets 91 and 92, and also have grooves to receive ribs R on the shafts 34 and 35. Sleeves 95 and 96 are smooth on the outside and can turn freely, but cannot move axially in the brackets 91 and 92.

Hence the rolls 18 and 22 and 19 and 23 can be moved towards and from each other along their axes of rotation. At the same time the distance between the rolls 18 and 19, and 22 and 23 can be regulated by moving bases 2 and 3 towards or from each other. To get the correct angle of the two shafts 34 and 35, the turrets 7 and 8 are rotated around the axes at points 60 and 61 in Figure 2; and the direction of the shafts 20 and 21 can be fixed by means of the wedge shaped parts 76 and 77. The rolls can thus always be adjusted as required and the most effective operation of the mill always secured.

Of course the nuts 86 are held against axial movement in the sleeves 87 and 90, as by collars or projections on the nuts engaging circumferential grooves inside the sleeves, so as to leave these nuts free to be turned as required.

I claim:

1. A rolling mill comprising rolls mounted to engage opposite sides of a piece of material to be worked, the rolls on one side of said material being adjustable towards or from those on the other side and the rolls on each side of said piece of material being adjustable towards and from each other and to vary the direction of their axes of rotation.

2. A rolling mill comprising a pair of turrets, a pair of shafts mounted on each of said turrets, the axes of the shafts on each of said turrets intersecting each other, means for moving said turrets towards and from each other without rotation, said means also acting to control said turrets for rotational adjustment, means on each of said turrets for adjusting the shafts longitudinally and additional means for adjusting one of said shafts laterally to change the direction of its axis.

3. A rolling mill comprising rolls mounted to engage opposite sides of a piece of material to be worked, the rolls on one side of said material being adjustable in unison with respect to those on the opposite side, and the rolls on each side of said material being adjustable with respect to each other.

4. A rolling mill comprising a shaft, bearings for said shaft, means comprising wedges for shifting the bearings transversely of said

shaft, and means for adjusting the position of said shaft axially in said bearings.

5. A rolling mill comprising a pair of turrets, a shaft supported in each of said turrets, the rotation of the turrets adjusting the angle between said shafts, a second shaft mounted in each of said turrets, bearings for the second shafts, and wedges to move the bearings to change the angle between said second named shafts.

6. A rolling mill comprising a pair of sliding bases, a pair of turrets one rotatably mounted on each base, shafts carrying rolls mounted on the turrets, a pair of spindles for each of the turrets to adjust the turrets towards and from each other by imparting sliding movement to the bases, and means including gearing for operating the spindles of each turret in unison, said means also being disengageable to enable the spindles for each turret to be operated separately to rotate the turrets.

7. A rolling mill comprising a pair of turrets, a shaft supported in each of said turrets and carrying a feed roll thereon, drive shafts for the shafts carrying said feed rolls, a second shaft supported in each turret with a discharge roll thereon, and drive shafts mounted in said turrets together with gearing for enabling said drive shafts to rotate the shafts carrying the discharge rolls.

8. A rolling mill comprising a turret, a pair of shafts mounted on said turret, one of said shafts carrying a feed-roll and the other a discharge roll, a shaft for driving the shaft carrying the feed-roll and a universal joint connecting these two shafts at one end of the mill, a third shaft mounted on the turret, gearing connecting said third shaft with the shaft mounting the discharge roll, a shaft for driving the third shaft and a universal joint connecting said last-named driving shaft with said third shaft adjacent the first-named universal joint, and means for shifting said turret.

9. A rolling mill comprising two pairs of rolls arranged at opposite sides of the work pass, means for adjusting said pairs of rolls as a unit relative to each other to position their work-engaging surfaces with respect to the opposite sides of the work, means for relatively adjusting corresponding rolls at opposite sides of the work pass to position their axes with respect to the axes of the remaining rolls and the path of movement of the work, and additional means for adjusting the rolls in each pair axially relative to each other.

In testimony that I claim the foregoing as my invention, I have signed my name hereto.

GUSTAV ASBECK.