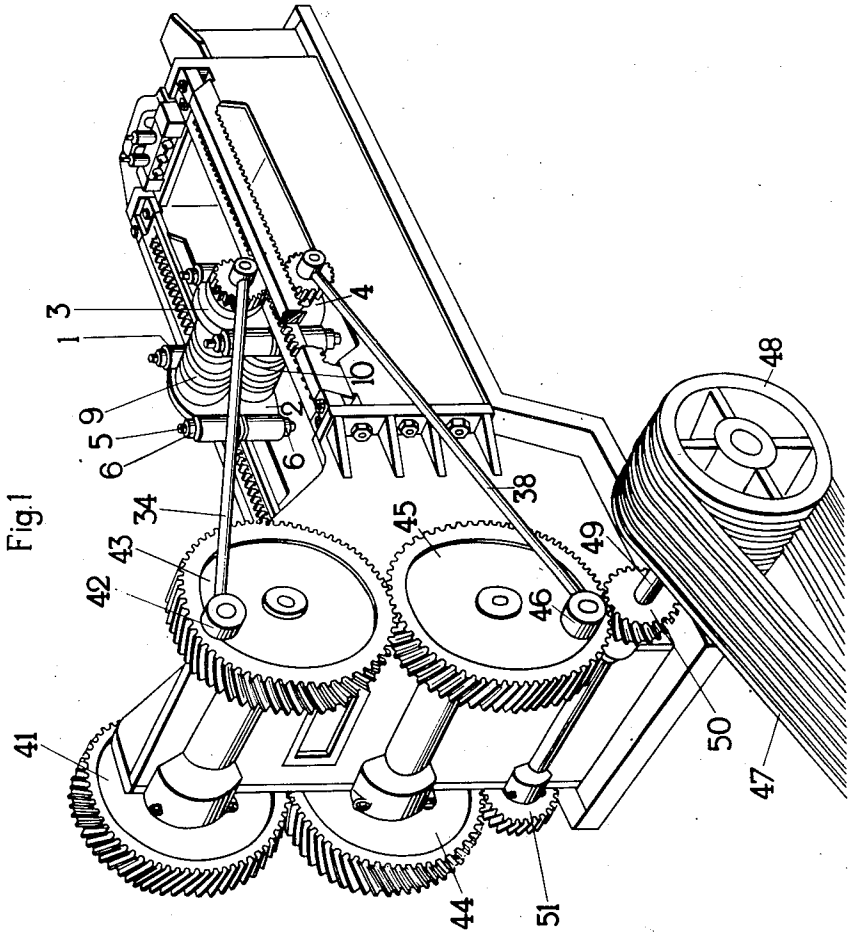
Feb. 12, 1957 P. S. E. FREDRIKSSON 2,780,948

ROLLING MILL

Filed Feb. 9, 1954 2 Sheets-Sheet 1

Fig. 1



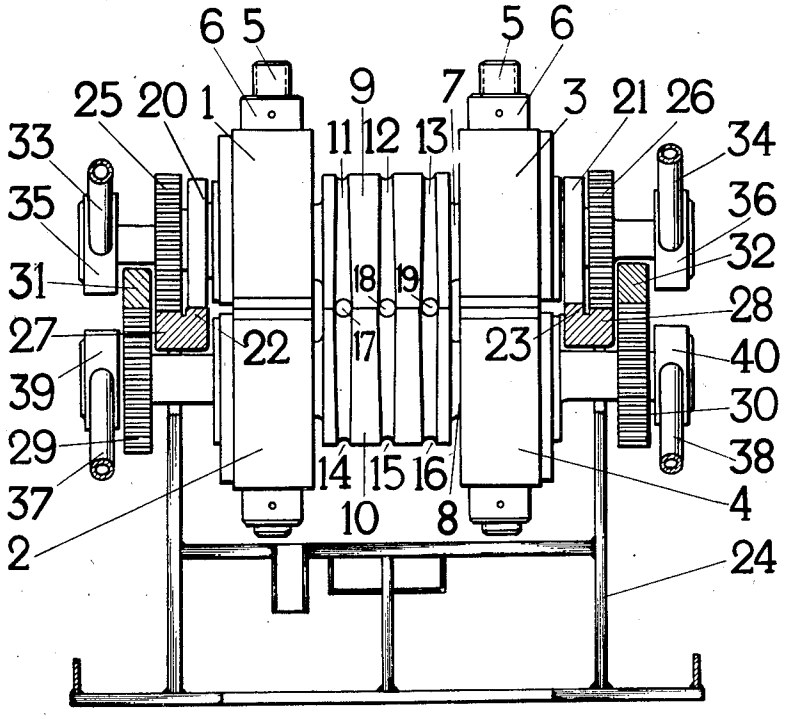
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Feb. 12, 1957 P. S. E. FREDRIKSSON 2,780,948

ROLLING MILL

Filed Feb. 9, 1954 2 Sheets-Sheet 2

Fig. 2



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ROLLING MILL

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5 Claims. (Cl. 80—14)

The present invention relates to rolling mills of the so-called step rolling or pilger type having a pair of co-operating, complementary grooved die-rolls or rockers, which are brought in a common reciprocation while being simultaneously turned about their axes to achieve an alternative constriction and widening of the space formed by the grooves between the rollers.

Rolling mills of substantially the above kind are previously known, wherein the complementary rockers are journalled in a roller support furnished with projecting members, provided with wheels in such a way that the support also constitutes a carriage, which in some way or other is brought to perform a reciprocating motion, the complementary rollers turning to and fro about their respective axes.

A carriage of this kind will run with its wheels on a suitable bed. However, in step rolling mill apparatus known hitherto the carriage will be very heavy due to its design, amongst others due to the fact that the wheels of the carriage are placed at a considerable distance from the space between the rollers and that the drive for the carriage applies forces in an unsymmetrical way in relation to said space, which will give rise to oblique-setting moments, which also should be considered when dimensioning the carriage. Due to the fact that the carriage thus will obtain considerable dimensions it will consequently obtain a large mass and the mass forces being encountered at the changes of the direction of motion will influence besides upon the carriage also upon the dimensions of the driving members for the same, bulky and expensive constructions being the result.

The invention, the object of which is to obtain a general reduction of the dimensions and mass forces and to provide a reliable and smoothly operating step rolling or pilger type rolling mill, is essentially characterized therein that the die-rolls or rockers, their geometric axes one above the other, are journalled in bearing blocks and further therein that supporting or carrying wheels are arranged coaxially to the upper rocker which wheels alone carry the said bearing blocks and rockers supported from essentially horizontal rails or races arranged for the carrying wheels so that said bearing blocks and rockers may be reciprocated as a carriage.

The invention will be more fully disclosed hereinafter with reference to an embodiment diagrammatically shown in the attached drawings and in connection therewith further characterizing features of the invention will be set forth.

Figure 1 is a perspective view of a rolling mill of the step rolling or pilger type according to the invention.

Figure 2 is a vertical section through the rolling mill according to Figure 1, the roller support or carriage and the complementary rollers or rockers journalled therein being shown in elevation.

In the embodiment of the step rolling mill according to the invention shown in the drawing the roller support proper comprises two separate blocks, which carry complementary die-rolls between them. Both blocks are divided into two halves 1, 2 and 3, 4 respectively, which are kept assembled by means of bolts 5 and nuts 6. The two upper block halves constitute bearings for a throughgoing roller shaft 7 and the two lower block halves constitute similarly bearings for a throughgoing roller shaft 8. The roller shaft 7 carries between the block halves 1 and 3 a grooved die-roll 9 and the roller shaft 8 carries between the block halves 2 and 4 a grooved die-roll 10. The grooves of the die-roll 9, which are three in number, are designated by 11, 12 and 13 and correspond to three grooves 14, 15, 16 in the lower die-roll 10. Said grooves present a semi-circular cross section and form in couples circular roller spaces or the like 17, 18, 19.

As will be evident particularly from Figure 2 the grooves taper along the periphery of the rollers similar to a wedge so that the roller spaces 17, 18 and 19 are reduced or increased upon turning the pair of rollers 9, 10 in order in known manner to render possible the reduction of tube or rod blank passed through the rolling mill.

Arranged on the roller shaft 7 outside the block are two runner wheels 20 and 21, which at will may be fixedly or loosely mounted on said shaft. Said runner wheels support the entire carriage, viz. the blocks, shafts and pair of roliers from two substantially horizontal runner rails 22 and 23, which are fixed to the main frame of the rolling mill, said main frame being designated by 24. When the carriage is brought into reciprocation the runner wheels 20 and 21 thus will run upon the runner rails 22 and 23.

It is a requirement, however, that simultaneously with the reciprocation of the carriage, both rollers 9 and 10 should be given a rotary motion, so that the roller spaces 17, 18 and 19 are alternatively widened and contracted. To this end the roller shaft 7 is provided with gears 25 and 26 fixedly attached thereto, which cooperate with racks 27 and 28 respectively, for the sake of expediency formed in the runner rail 22 and 23 respectively. In a corresponding way the roller shaft 8 is provided with the gears 29 and 30, which cooperates with racks 31 and 32 respectively, which are also fixed to the frame 24. It should be noted that both pairs of racks 27, 31 and 28, 32 respectively may be mutually adjustably displaced in a horizontal direction for the purpose of adjusting the roller space and to provide for that the engagement between the teeth will be equal on both sides. Furthermore it may be mentioned that the diameters of the runner wheels 20, 21, particularly in those cases when they are rigidly attached to the roller shafts, are chosen so as to coincide with the pitch diameters of said gears. Furthermore it should be mentioned that the pitch diameter of the gears and furthermore the diameters of the runner wheels are preferably chosen so that they will lie between the maximal and minimal pitch diameter of the roller groove in view of the varying pitch diameter for the latter at its engagement with the tube or rod blank being constricted in the roller space.

In accordance with Figures 1 and 2 on the shaft 7 at each of its ends a connecting rod 33 and 34 respectively engages with a connecting rod end 35 and 36 respectively, free on the shaft. In a corresponding way on the shaft 8 two connecting rods 37 and 38 engage with pivoted connecting rod ends 39 and 40. The connecting rod 33 is by means of a connecting rod end pivotally supported from a gear 41 formed as a flywheel. Likewise the connecting rod 34 by means of a connecting rod end 42 is pivotally supported from a similar gear 43, gear 41 engaging a similar gear 44 and the gear 43 with a gear 45. The gear 44 by means of a connecting rod end not shown is connected to the connecting rod 37 and also the gear 45 by means of a connecting rod end 46 to the connecting rod 38.

Rotation is imparted from a motor, not shown via V-belts or the like 47 to a pulley 48 on a shaft 49 carrying two driving gears 50 and 51 in mesh with the gear 45 and 44 respectively.

When rotation is imparted to the pulley 48 both gears 50 and 51 are driven and simultaneously the pairs of gears 44, 41 and 45, 43 are put in rotation to drive, through the connecting rods 33, 34, 37, 38, the blocks etc. and also the rollers 9 and 10 in a horizontal direction while simultaneously turning of the same to alternatively increase and constrict the circular roller spaces 17, 18, 19, through which, in a known manner, the tube or rod blanks are successively passed to obtain a reduced cross section. In such connection it should also be mentioned, that it is preferable not to have the grooves in the rollers extending the entire periphery of the rollers. Care should namely be taken that certain portions of the periphery is left free for the arrangement of descents or reduced portions, so that the blanks handled are getting disengaged from the rollers or rockers in the turning positions of the carriage, while the blanks are advanced and turned respectively. A preferred length of the groove corresponds in accordance with invention to about 320° of the periphery of the roller or rocker.

As will be particularly evident from Figure 1 the connecting rods engage both axes of the rollers in a symmetrical way in relation to the roller space and furthermore the carriage assemblage travels on a race, which essentially coincides with the horizontal centre plane of the roller space, which is particularly important, since thereby the oblique-setting moments encountered in other known roller carriages in step rolling mills are eliminated. Furthermore it should be noted that the symmetrical arrangement of all of the connecting rods contributes to the fact that the horizontal resultant of the forces transmitted by the connecting rods remain in the plane of the roller space. As is evident from the aforesaid in accordance with the invention it is aimed at as far as technically possible to eliminate oblique-setting moments and to reduce weight of the roller carriage, whereby the mass forces may be reduced to such figures that the assemblages may be given correspondingly slender dimensions.

Although, in the embodiment shown, rollers having three grooves are shown, this does not exclude the utilization of roller having another desired number of grooves.

The invention is not limited to the embodiment shown and described but may be varied in several respects within the scope of the basic inventive idea.

Having now described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. A step rolling mill of the pilger type comprising a frame, spaced, parallel, substantially horizontal tracks on said frame, a pair of cooperating, complementary, grooved rollers, bearing blocks rotatably mounting said rolls in operative relationship, said rolls being disposed one above the other, a roll shaft extending from each end of each roll beyond said bearing blocks, a wheel mounted on each end of the upper roll shaft outwardly of said bearing blocks and engaging said tracks to reciprocably support said rolls and said bearing blocks, a gear fixed on each end of said upper roll shaft outwardly of said wheels, spaced, parallel racks carried by said frame and engaging said gears, a second gear fixed on each end of the lower roll shaft outwardly of said bearing blocks, spaced, parallel racks carried by said frame and engaging said second gears, a connecting rod rotatably secured to each end of each roll shaft outwardly of said first and second gears and crank means connected to said connecting rods whereby upon operation of said crank means, said rolls and said bearing blocks will be reciprocated as a unit along said tracks and maintained in upright position by said connecting rods, the engagement of said gears with said racks causing simultaneous rotation of said rolls.

2. A step rolling mill of the pilger type comprising a frame, spaced, parallel, substantially horizontal tracks on said frame, a pair of cooperating, complementary, grooved rolls, bearing blocks rotatably mounting said rolls in operative relationship, said rolls being disposed one above the other, a roll shaft extending from each end of each roll beyond said bearing blocks, a wheel mounted on each end of the upper roll shaft and engaging said tracks to reciprocably support said rolls and said bearing blocks, a gear fixed on each end of said upper roll shaft outwardly of said bearing blocks, spaced, parallel racks carried by said frame and engaging said gears, a second gear fixed on each end of the lower roll shaft outwardly of said bearing blocks, spaced, parallel racks carried by said frame and engaging said second gears, a connecting rod rotatably secured to each end of each roll shaft outwardly of said first and second gears and crank means connecting to said connecting rods whereby upon operation of said crank means, said rolls and said bearing blocks will be reciprocated as a unit along said tracks and maintained in upright position by said connecting rods, the engagement of said gears with said racks causing simultaneous rotation of said rolls.

3. A step rolling mill of the pilger type comprising a frame, spaced, parallel, substantially horizontal tracks on said frame, a pair of cooperating, complementary, grooved rolls, bearing blocks rotatably mounting said rolls in operative relationship, said rolls being disposed one above the other, a roll shaft extending from each end of each roll beyond said bearing blocks, a wheel mounted on each end of the upper roll shaft and engaging said tracks to reciprocably support said rolls and said bearing blocks, a gear fixed on each end of said upper roll shaft outwardly of said bearing blocks, spaced, parallel racks carried by said frame and engaging said gears, a second gear fixed on each end of the lower roll shaft outwardly of said bearing blocks, spaced, parallel racks carried by said frame and engaging said second gears, a connecting rod rotatably secured at each end of each roll shaft outwardly of said first and second gears and reciprocating means connected to said connecting rod whereby upon operation of said reciprocating means said rolls and said bearing blocks will be reciprocated as a unit along said tracks and maintained in upright position by said connecting rods, the engagement of said gears with said racks causing the simultaneous rotation of said rolls.

4. A step rolling mill of the pilger type comprising a frame, spaced, parallel, substantially horizontal tracks on said frame, a pair of cooperating, complementary, grooved rolls, bearing blocks rotatably mounting said rolls in operative relationship, said rolls being disposed one above the other, a roll shaft extending from each end of each roll beyond said bearing blocks, a wheel mounted on each end of the upper roll shaft and engaging said tracks to reciprocably support said rolls and said bearing blocks, a gear fixed on each end of said upper roll shaft, spaced, parallel racks carried by said frame and engaging said gears, a second gear fixed on each end of the lower roll shaft, spaced, parallel racks carried by said frame and engaging said second gears, a connecting rod rotatably secured to each end of each roll shaft outwardly of said first and second gears and reciprocating means connected to said connecting rods whereby upon operation of said reciprocating means said rolls and said bearing blocks will be reciprocated as a unit along said tracks and maintained in upright position by said connecting rods, the engagement of said gears with said racks causing simultaneous rotation of said rolls.

5. A step rolling mill of the pilger type comprising a frame, spaced, parallel, substantially horizontal tracks on said frame, a pair of cooperating, complementary, grooved rolls, bearing blocks rotatably mounting said rolls in operative relationship, said rolls being disposed one above the other, a roll shaft extending from each end of each roll, a wheel mounted on each end of the

upper roll shaft and engaging said tracks to reciprocably support said rolls and said bearing blocks, a gear fixed on each end of said upper roll shaft, spaced, parallel racks carried by said frame and engaging said gears, a second gear fixed on each end of the lower roll shaft, spaced, parallel racks carried by said frame and engaging said second gears, a connecting rod rotatably secured to each end of each roll shaft and reciprocating means connected to said connecting rods whereby upon operation

of said reciprocating means said rolls and said bearing blocks will be reciprocated as a unit along said tracks and maintained in upright position by said connecting rods, the engagement of said gears with said racks causing simultaneous rotation of said rolls.

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