Dec. 25, 1923. 1,478,772

R. C. STIEFEL

TUBE REDUCING MILL

Filed April 19, 1922 4 Sheets-Sheet 1

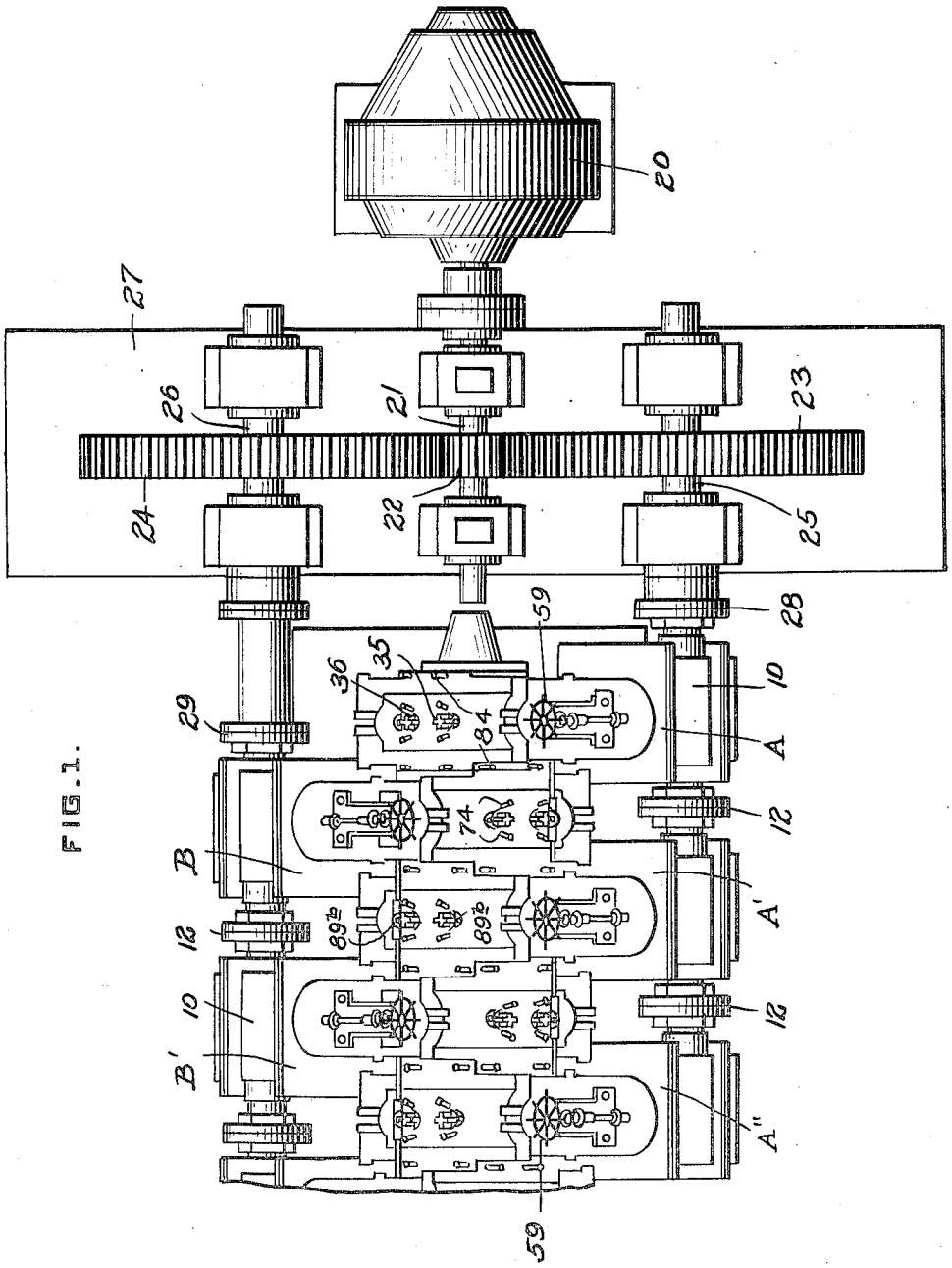


FIG. 1.

WITNESSES

J. Hobart Bradley

INVENTOR

Ralph C. Stiefel

By Hunter & Brown

His attys.

Dec. 25, 1923. 1,478,772

R. C. STIEFEL

TUBE REDUCING MILL

Filed April 19, 1922 4 Sheets-Sheet 2

FIG. 2.

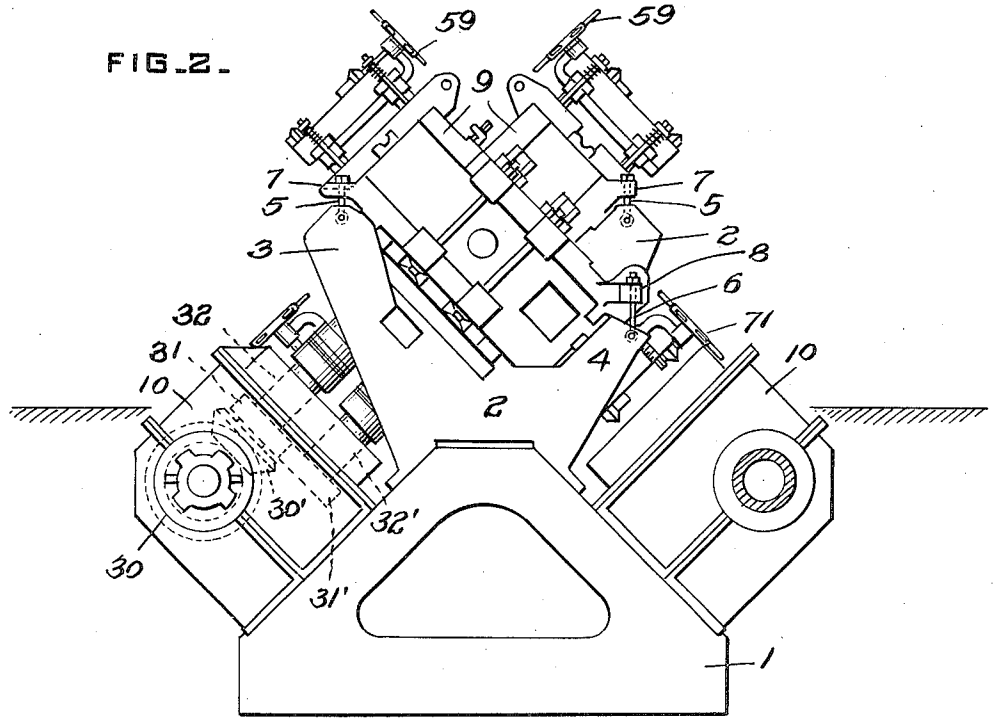


FIG. 8.

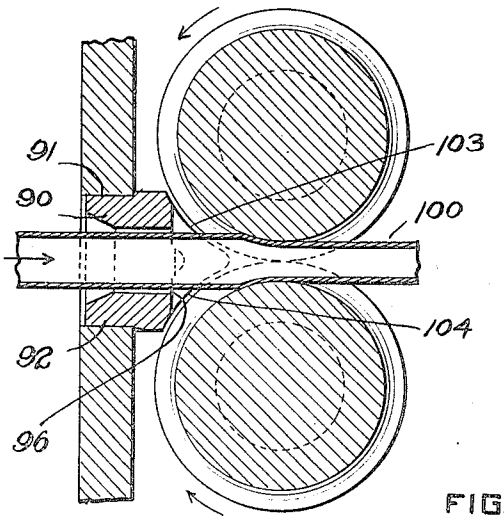


FIG. 9.

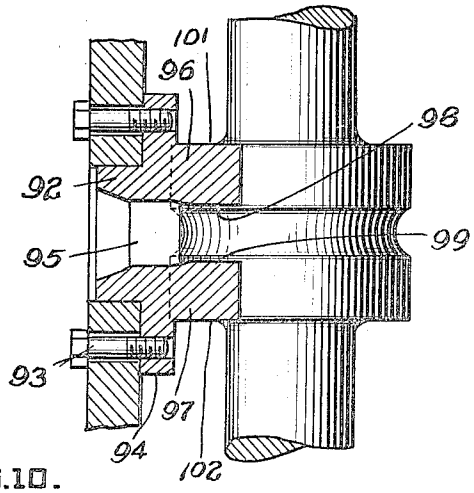
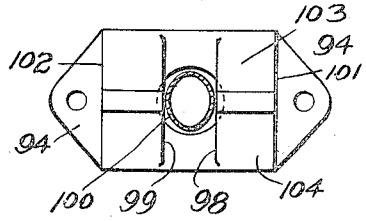


FIG. 10.



WITNESSES

J. Herbert Bradley.

INVENTOR

Ralph C. Stiefel

By Winter & Brown

His Attys.

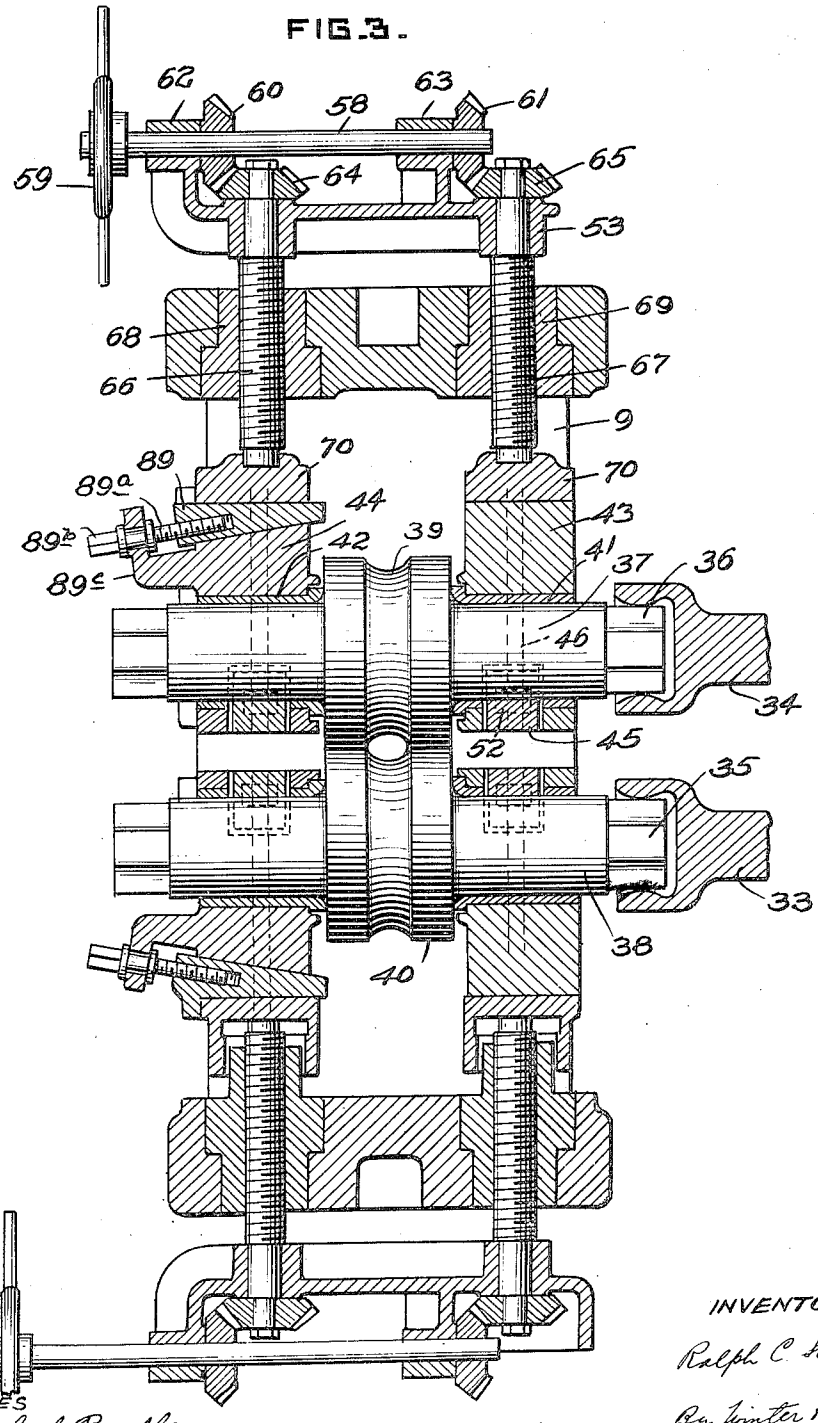
Dec. 25, 1923. 1,478,772

R. C. STIEFEL

TUBE REDUCING MILL

Filed April 19, 1922 4 Sheets-Sheet 3

FIG. 3.



WITNESSES

J. Herbert Bradley

INVENTOR

Ralph C. Stiefel

By Winter & Brown

His Attys.

Dec. 25, 1923. 1,478,772

R. C. STIEFEL

TUBE REDUCING MILL

Filed April 19, 1922 4 Sheets-Sheet 4

FIG. 4.

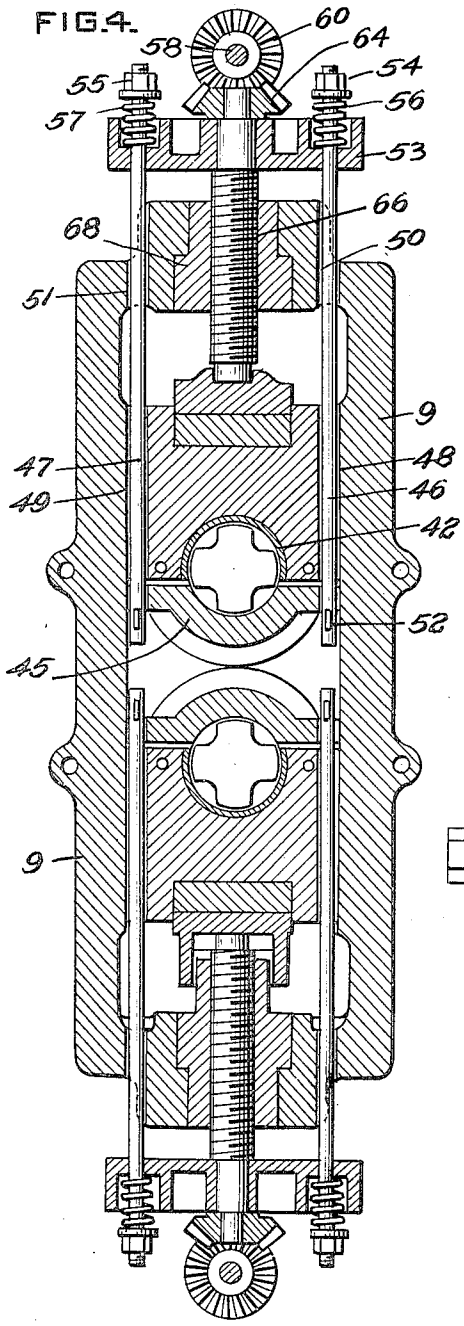


FIG. 5.

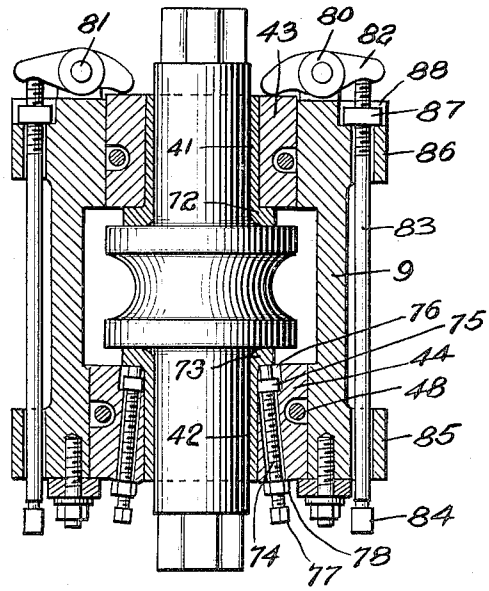


FIG. 6.

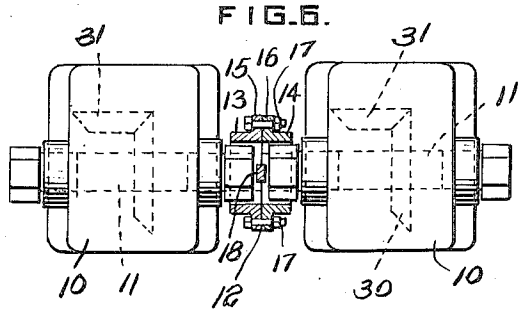
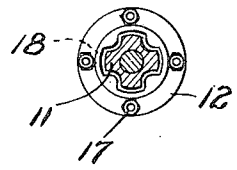


FIG. 7.



WITNESSES

J. Herbert Bradley.

INVENTOR

Ralph C. Stiefel

By Winter & Brown

His Attys.

Patented Dec. 25, 1923. 1,478,772

UNITED STATES PATENT OFFICE.

RALPH C. STIEFEL, OF ELLWOOD CITY, PENNSYLVANIA.

TUBE-REDUCING MILL.

Application filed April 19, 1922. Serial No. 555,586.

To all whom it may concern:

Be it known that I, RALPH C. STIEFEL, a citizen of the United States, and a resident of Ellwood City, in the county of Lawrence and State of Pennsylvania, have invented a new and useful Improvement in Tube-Reducing Mills, of which the following is a specification.

This invention relates to tube reducing mills, and particularly mills for reducing the diameter of tubes while in a hot state by passing successively through a number of roll pairs, each succeeding roll pair being provided with progressively smaller grooves and driven at progressively greater speed, the roll pairs being alternately disposed at right angles to each other.

In mills of this character, due to the comparatively small reduction which can be effected in a single roll pair, it is frequently necessary to employ as many as 18 to 20 roll pairs to secure the desired reduction, and on account of the large number of roll pairs required, it is highly desirable to have a mill in which the alignment of the rolls along the center line of the roll passes may be easily and quickly accomplished. It is the object of this invention to provide a mill in which such alignment may be readily made.

Special objects of the invention are to provide an apparatus in which the rolls of each pair may be easily adjusted towards and away from the pass line for varying the size of the pass opening or throat thereof, to provide means for adjusting each roll in an axial direction so as to readily center both rolls of the pair centrally and symmetrically of the common pass, to provide adjusting means for the several roll bearings so as to maintain the shafts of cooperating rolls in parallel relation, whereby the roll passes of the individual units comprising the entire mill may be aligned with the common center line of all roll passes.

It is a further object to provide a mill in which each unit thereof may be quickly and easily removed for necessary repairs and replacement without interfering with the driving of the remaining units, and it is still a further object to provide an apparatus in which the tube operated upon is properly guided to the grooves of each succeeding pair of rolls.

It is also a special object of the invention to provide a mill in which all actuating means for effecting the adjustments above referred to are located at the front side of each unit comprising the mill.

These and other objects of the invention will more readily appear when taken in connection with the following description and the appended claims.

In the accompanying drawings Fig. 1 is a fragmentary plan view disclosing several units comprising the preferred embodiment of the invention; Fig. 2 an end elevational view illustrating the method of mounting the several units and the relative disposition of the axes of the two series of inclined units; Fig. 3 a sectional elevation taken longitudinally through one of the roll housings, illustrating the mechanism for adjusting the roll shafts bodily towards and away from the roll pass; Fig. 4, a view similar to Fig. 3 taken in a plane at right angles to that of said figure; Fig. 5 a transverse sectional view with parts in elevation illustrating the means for axially adjusting the roll shafts; Fig. 6 an elevational view with parts in section illustrating the gear boxes associated with the several units and the coupling connections for joining the driving shafts thereof; Fig. 7 a transverse sectional view taken in a plane showing the driving shaft adjacent the coupling connection; Fig. 8 a fragmentary vertical sectional view of the combined guiding and indicating means employed in connection with each unit; Fig. 9 a view similar to Fig. 8 taken in a plane at right angles to that of Fig. 8, and Fig. 10 an elevational view of the guide block illustrating the relation of its guiding faces to the transverse axes of the tube operated upon.

In the drawings 1 designates a supporting base or bed upon which are mounted the saddles 2 having the limbs 3 and 4, the limb 3 being of greater length than limb 4, and each succeeding pair of saddles being faced in opposite directions.

The entire mill comprises the desired number of rolling units, 18 or 20 being preferred. Each unit is complete in itself, being supported upon the saddles 2 and locked in position by means of the pivotal bolts 5 and 6 that cooperate with the lugs 7 and 8 formed upon the roll housing.

In Fig. 1 but five units are shown, the alternate units A, A′ and A″ forming a part of one series, and the alternate units B, B′ forming a part of a second series, the several units of each series being similarly dis-

posed, with the axes of the two series lying in planes which intersect at substantially right angles, the units of both series being inclined to the horizontal at about 45 degrees, as clearly shown in Fig. 2. Each of the several units of both series are identical in construction except that the sizes of the roll passes progressively decrease and the speeds of rotation of the rolls progressively increase from the receiving to the discharging end of the mill, as is common in reducing mills of this character. With this exception, the units are identical in construction and therefore one only need be described in detail. Each unit consists of a roll housing 9 in which the rolls are mounted, and a gear box 10 supported upon the base 1, as indicated in Fig. 2. Suitably journalled in each gear box is a driving shaft 11, the extremities of which extend but a short distance beyond the sides of the box and are of non-circular shape in cross section being preferably in the form of a cross, the ends of which are rounded. The form of such extremities is best illustrated in Fig. 7. The ends of the shafts of adjacent gear boxes of the same series extend within a short distance of each other and are operatively jointed by means of coupling connections 12 consisting of two halves 13 and 14 provided with the abutting flanges 15 and 16 bolted together at 17. Extending between the shaft ends and clamped between the two halves 13 and 14 is a driving key or bar 18. These loose coupling connections not only permit uneven wearing of the bearings of the driving shafts without causing binding therein but provide means for readily detaching the driving gearing of the several units, permitting the removal of any gear box without interfering with the others, it being merely necessary to remove the bolts 17 in order to detach the coupling.

Power is supplied to the shafts of the several gear boxes by means of an electric motor 20, the armature shaft of which is coupled to the main driving shaft 21, carrying the pinion 22 which meshes with the gears 23 and 24 fixed to the auxiliary shafts 25 and 26 respectively, all of which shafts are suitably journalled upon bearings supported upon the base plate 27. The shafts 25 and 26 are coupled at 28 and 29, respectively, to the two series of units previously mentioned.

The driving shaft 11 of each unit is associated through suitable gearing such as the beveled gears 30, 30′, spur pinions 31, 31′, and shafts 32, 32′ for causing the actuation of wobblers 33 and 34 engaging the specially formed extremities 35 and 36 of the respective roll shafts, such extremities being similar in cross sectional shape to that of the extremities of shaft 11, as clearly illustrated in Figs. 3 and 4.

The upper and lower roll shafts are indicated at 37 and 38 and carry the respective rolls 39 and 40 which cooperate in the usual and wellknown manner. The opposite ends of each of these shafts are journalled in bearings 41 and 42 carried by bearing blocks 43 and 44, which blocks are slidably mounted within the roll housing 9. Each of the bearings is recessed near its central portion for the reception of the bearing yoke 45 through the apertured ends of which extend the vertical rods 46 and 47 which project through grooves 48 and 49 formed in the bearing blocks, thence through guiding openings 50 and 51 in the housing 9, the bearing yoke being retained on the rods 46 and 47 by means of transverse keys 52. The yoke 45 is yieldingly mounted by the rods 46 and 47 the upper extremities of which pass through the crosspiece 53 and are threaded to receive the nuts 54 and 55, between which and the cross piece are disposed the coiled compression springs 56 and 57.

In order to adjust the roll shaft toward and away from the roll pass, an actuating rod 58 provided with a hand wheel 59 and carrying pinions 60 and 61 is suitably journalled in bearing brackets 62 and 63 formed on the cross-piece 53. Pinions 60 and 61 mesh with beveled pinions 64 and 65 fixed to the extremities of the shafts 66 and 67, respectively, also journalled in the cross piece, as clearly shown in Fig. 3. The main portions of the shafts 66 and 67 are threaded for engaging the threaded sleeves 68 and 69 fixed in the housing 9. The extremities of the shafts rest in socket pieces 70 mounted in suitable grooves in the bearing blocks. It is obvious from the above description that rotation of the hand wheel 59 in one direction will force the bearing blocks, and consequently the roll shaft towards the roll pass, and rotation thereof in the opposite direction will permit the roll shaft to be moved away from said pass under the influence of springs 56 and 57. Similar adjusting means for the lower roll shaft 38 are also provided, being adapted to be actuated through the hand wheel 71. By these adjustments the two rolls may be bodily moved to the desired distance from the roll pass to vary the size of the pass there between.

Means for adjusting each of the rolls and roll shafts in an axial direction are also provided, being clearly illustrated in Fig. 5. The bearings 41 and 42 have at their inner ends flanged portions 72 and 73, respectively, which are adapted to abut the opposite sides of the rolls, lying between the roll and the bearing block associated with the bearing. Extending through passages in bearing block 44 at the front of the machine and disposed at opposite sides of the roll shaft are threaded bolts 74 which contact the

flange 73. The inner end of the bolt is provided with a nut 75 disposed within a recess 76 formed by enlarging the extremity of the passage for such purpose. The bolts are also provided with the usual squared heads 77 lock nuts 78. Fulcrumed at 80 and 81 on the housing 9 at the rear side thereof, and at opposite sides of the shaft, are rocker arms 82 one end of which is adapted to contact bearing block 43 while the other abuts the end of an adjusting screw bolt 83 provided with an actuating head 84 disposed at the front of the housing adjacent to bolts 74. The bolts 83 pass through and are supported by a pair of apertured ears 85 and 86 formed upon the side of the housing, the nuts 87 cooperating with threaded portion of the bolts and are retained within recesses indicated at 88. By loosening the bolts 83 to remove the pressure of the rocker arms 82 against bearing block 43, the roll shaft may be shifted toward the rear of the housing by turning the bolts 74 in a direction to force the bearing 42 in such direction, or by first retracting the bolts 74 and subsequently rotating the bolts 83 the rocker arms may be actuated to shift the bearing block 43 and its associated bearing 41 towards the front of the housing carrying with it the roll shaft. It is thus seen that by manipulation of the bolts 74 and 83, the actuating heads of both of which are located at the front of the housing, the roll shaft may be shifted axially to any desired position so as to properly center the rolls with respect to the roll passes.

In order to adjust the roll shafts angularly so as to bring them into exact parallel relation with each other, each of the front bearing blocks is provided with a suitable wedge 89, disposed between the socket piece 70 and the body of the block. The wedge is actuated by a bolt 89^a having a squared head 89^b anchored in a bracket 89^c projecting from the front of the bearing block. By moving the appropriate wedge 89 in the proper direction, the bearing block may be lifted or depressed to bring the roll shaft into the desired position.

For guiding the tube acted upon from one unit to the next succeeding unit, the guide block 90, illustrated in Figs. 8 to 10, is employed, the same being specially constructed and mounted to also serve as an indicator, facilitating the setting of the roll shafts when adjusting the rolls either towards or away from the roll pass, or in an axial direction. The side member of each roll housing is provided with a circular opening 91, these openings being so located as to be in exact alignment when the several units are in fixed position upon their respective supporting saddles. The guide block 90 is provided with a boss 92 adapted to snugly fit the opening 91, being held in position by means of threaded bolts 93 engaging lateral ears 94 on the guide. A circular aperture 95 flared slightly outwardly at its inlet end, extends through the body of the block and is concentrically disposed with relation to the boss 92 and the opening 91 in the housing, so as to be located exactly in alignment with the roll pass. Projecting inwardly from the body of the guide is a pair of spaced wings 96 and 97 symmetrically arranged, the vertical faces of which are straight and lie in parallel planes as clearly shown in Figs. 9 and 10. The shape of the roll pass of each unit, except the last which is made perfectly circular, is oval, as clearly shown in Fig. 3, and the shape of the tube as it passes to each succeeding unit corresponds thereto as illustrated in Fig. 10. The inner adjacent faces 98 and 99 are spaced apart a distance slightly less than the diameter of the aperture 95, so as to hug tube 100 along its shortest transverse dimension, the diameter of the aperture corresponding to the longest transverse dimension of the tube.

The distance between the outer vertical faces 101 and 102 exactly equals the length of the body of the roll, as clearly shown in Fig. 9. The top and bottom faces 103 and 104 of the wings are curved, the said faces being arcuate in form and concentric with the axes of the roll shafts when properly centered with respect to the roll pass. Such construction serves as an effective indicator facilitating either axial or bodily adjustment of the roll toward or away from the roll pass. By moving the roll shaft axially until the end faces of the roll body are brought into exact alignment with the outer vertical faces 101 and 102 of the wings, and by observing the relative relation and distance between the curved faces of the wings and the periphery of the rolls, the same may be accurately and correspondingly adjusted bodily towards or away from the pass.

The general mode of operation of the mill is obvious from the above description and corresponds to that of mills employing a series of reducing rolls having successive roll sets disposed in planes at right angles. The tube is introduced to the initial unit and passes progressively through the succeeding units, being guided from one unit to the next by means of the guides 90, above described, the diameter of the tube being gradually reduced during its passage in a well known manner. By the several adjustments described, the rolls of each unit may be shifted bodily towards or away from the general pass line, in an axial direction, or angularly to bring the shafts of cooperating rolls into exact parallel relation, whereby to accurately center and align the roll passes of each unit with respect to the common pass line of the entire series, and

all of the actuating means for the several adjustments are disposed at the front side of the roll housings so as to be within easy reach of the operator, thus facilitating such adjustments. It is also noted that by providing each unit with a separate and independent gear box which can be readily detached, the same may be removed without disturbing the remaining ones, being an important feature in the practical operation of the mill.

Although the preferred embodiment of the invention has been illustrated and described, as required by the patent statutes, it is obvious that many changes in the details of construction of the several parts may be made without departing from the spirit of the invention, and it is therefore not intended to limit the invention beyond that specifically pointed out in the appended claims.

I claim:

1. A tube reducing mill comprising a roll housing, a pair of rolls journalled in said housing, means for adjusting the rolls bodily towards and away from each other, means for adjusting the rolls in an axial direction, means for adjusting the angularity of the rolls, actuating means for each of said adjusting means, all said actuating means being disposed at one side of the housing.

2. A tube reducing mill comprising a roll housing, cooperating rolls journalled therein, a bearing for each end of the roll shafts, means for axially shifting the shaft bearings in one direction, means for axially shifting said bearings in the opposite direction, both said means being adapted to be actuated from the same side of the housing.

3. A tube reducing mill comprising a roll housing, cooperating rolls journalled therein, a bearing for each end of the roll shafts, a threaded bolt abutting the bearing at one end of the shaft for axially moving the same in one direction and adapted to be actuated from the front of the housing, a rocker arm for axially moving the bearing at the other end of the shaft in the opposite direction, and a second threaded bolt also adapted to be actuated from the front of the housing for actuating the rocker arm.

4. A tube reducing mill comprising a roll housing cooperating rolls journaled therein, bearings axially movable with the roll shaft for supporting the same, a threaded bolt abutting the bearing at one side of the housing for axially shifting both bearings in one direction, a rocker arm abutting the bearing at the opposite side of the housing for axially moving both bearings in the reverse direction, and means disposed adjacent the bolt for actuating the rocker arm.

5. A tube reducing mill comprising a housing, co-operating rolls journalled in the housing, an opening in the housing, a guide having an aperture in alignment with the roll pass fixed in said opening, the body of said guide being provided with a pair of spaced wings projecting therefrom, the distance between the outer side faces of the wings being equal to the width of the body of the rolls whereby to serve as an indicator in axially adjusting the said rolls.

6. A tube reducing mill comprising a housing, cooperating rolls journalled in the housing, an opening in the housing in alignment with the roll pass, a guide having a circular aperture also in alignment with the roll pass fixed therein, the body of the guide being provided with a pair of spaced wings projecting therefrom, the inner adjacent faces of the wings being straight and spaced apart a distance slightly less than the diameter of the aperture, and the width of the body of the guide being equal to the width of the body of the rolls whereby to serve as an indicator in axially centering the said rolls.

7. A tube reducing mill comprising a housing, co-operating rolls journalled in the housing, a circular opening in the housing in alignment with the roll pass, a guide provided with a boss fitting in the said opening and having a circular aperture there-through concentric with the said boss, a pair of spaced wings extending from the guide, each of said wings having straight vertical faces, the inner adjacent faces of the wings being spaced apart a distance slightly less than the diameter of the aperture, and the distance between the outer faces being equal to the length of the body of the rolls whereby to serve as an indicator in axially centering the said rolls.

8. A tube reducing mill comprising a housing, cooperating rolls journalled in the housing, a circular opening in the housing in alignment with the roll pass, a guide provided with a boss fitting in said opening and having a circular aperture therethrough concentric with said boss, a pair of spaced wings extending from a guide body and arranged symmetrically with respect to the said aperture, the upper and lower faces of said wings being provided with curved surfaces concentric with the axes of the rolls when properly centered with respect to the roll pass, whereby to serve as an indicator in adjusting the rolls bodily towards and away from the said pass.

9. A tube reducing mill comprising a housing, cooperating rolls journalled in the housing, a circular opening in the housing in alignment with the roll pass, a guide provided with a boss fitting in said opening and having a circular aperture therethrough concentric with the said boss, a pair of spaced wings extending from the

guide body and arranged symmetrically with respect to the said aperture, the upper and lower faces of said wings being provided with curved surfaces concentric with the axes of the rolls when properly centered with respect to the roll pass whereby to serve as an indicator in adjusting the rolls bodily towards and away from the roll pass, each of said wings also having straight inner and outer vertical parallel faces, the inner vertical faces being spaced apart a distance slightly less than the diameter of the aperture, and the distance between the outer vertical faces being equal to the length of the body of the rolls whereby to serve as an indicator in axially adjusting the said rolls.

In testimony whereof, I sign my name.

RALPH C. STIEFEL.

Witnesses:

GEORGE A. PUGH,

N. A. CLARK.