July 2, 1940. P. B. ABRAMSEN 2,206,759

CROSS ROLLING

Filed Aug. 11, 1938 3 Sheets-Sheet 1

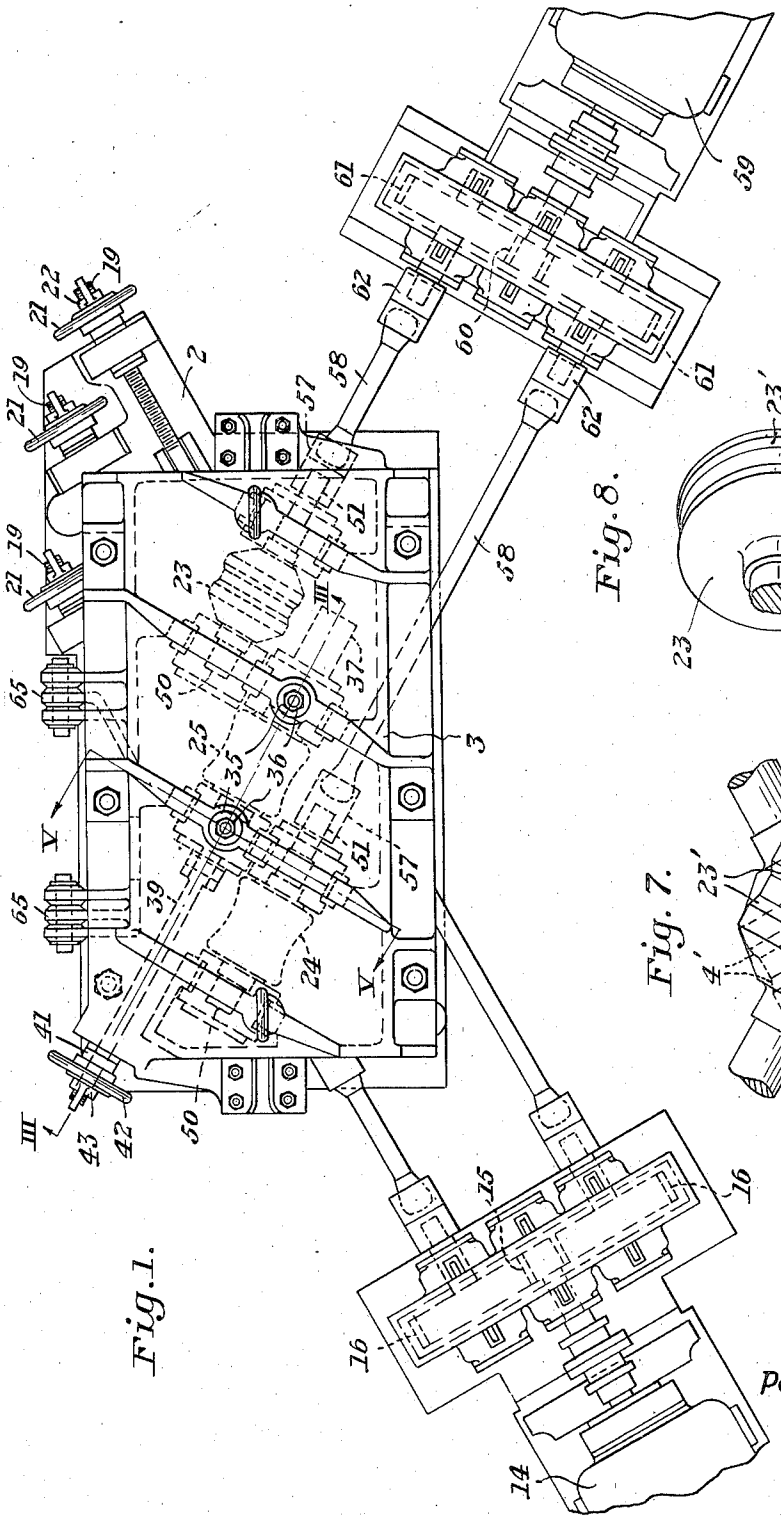

Fig. 1.

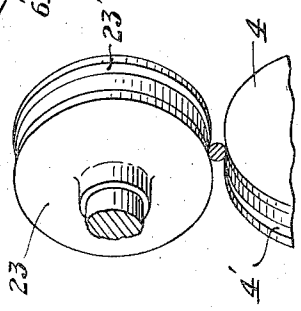

Fig. 8.

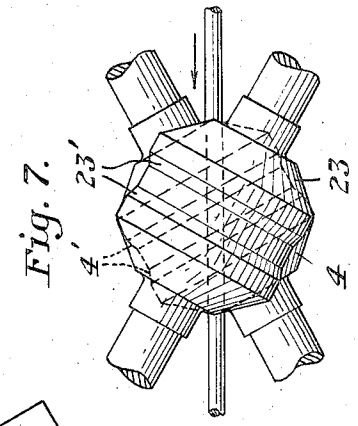

Fig. 7.

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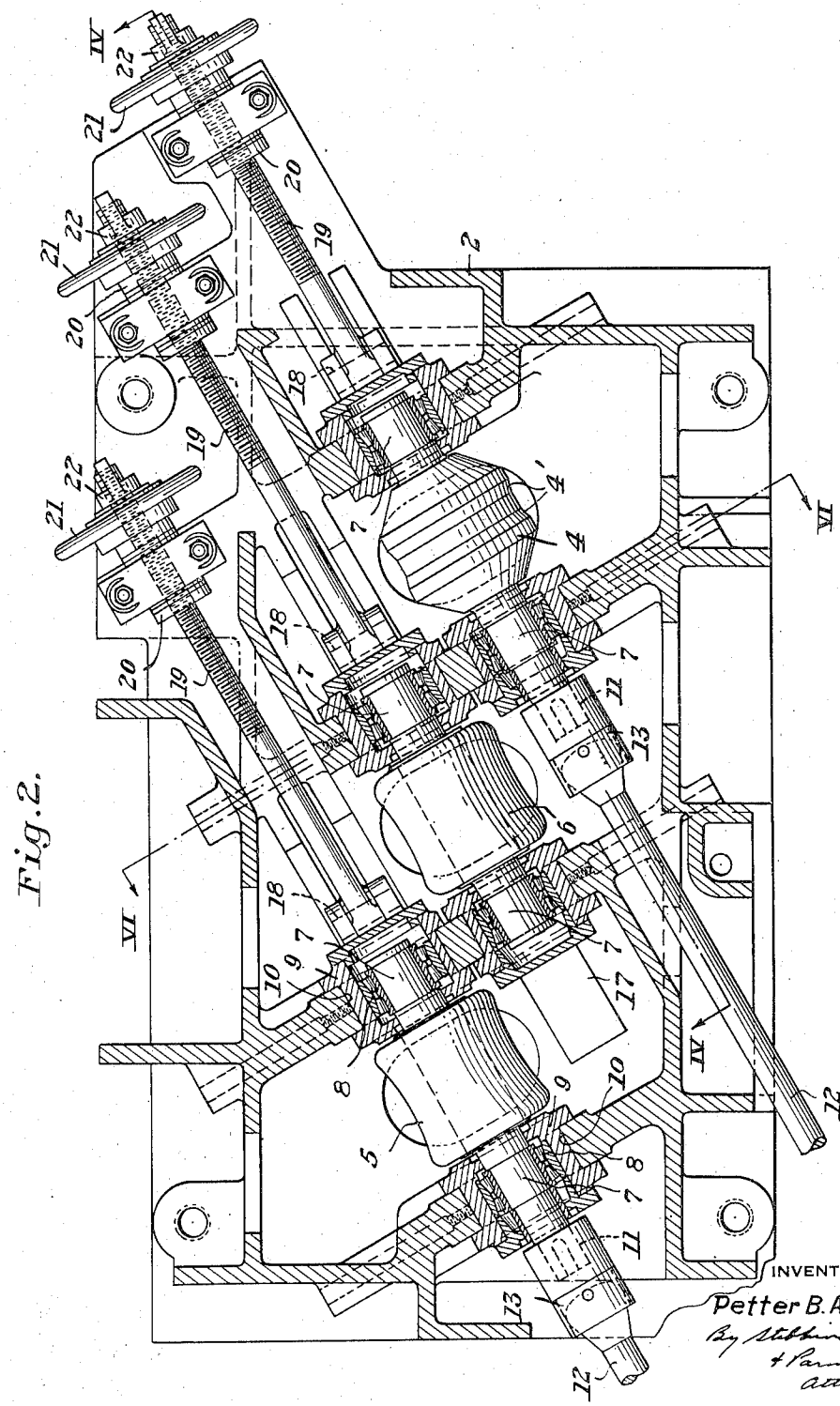

Fig. 2.

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Fig. 3.

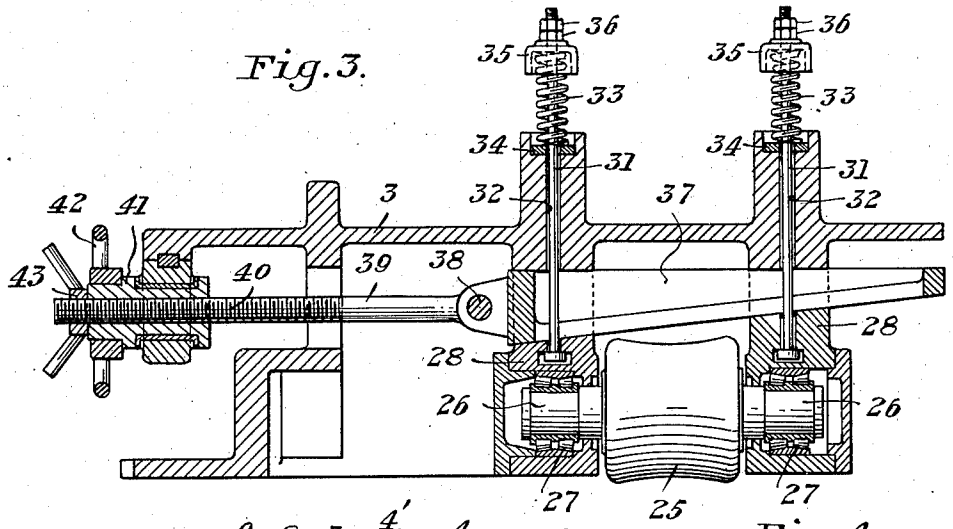


Fig. 4.

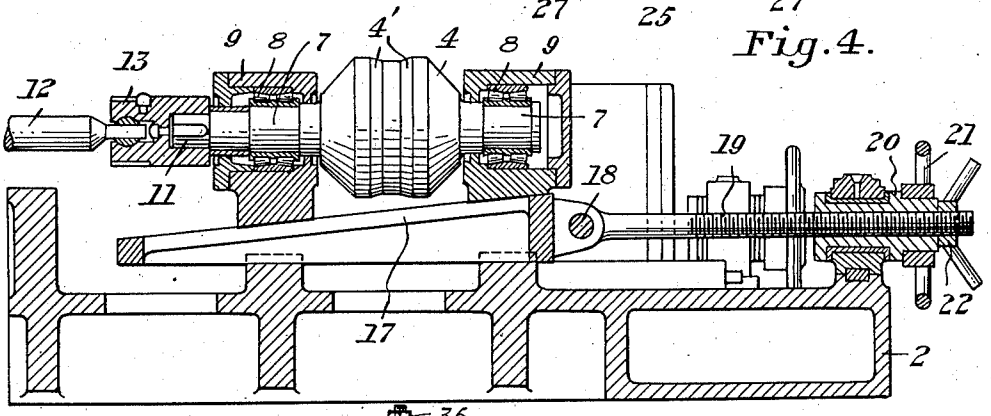


Fig. 5.

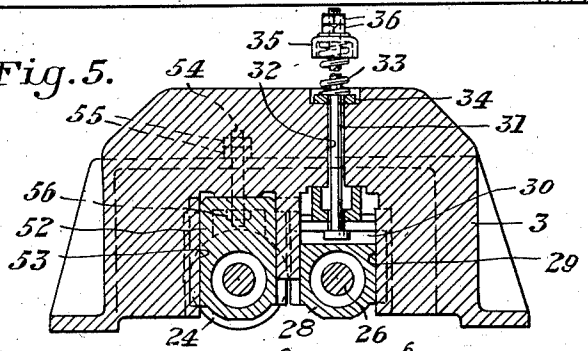
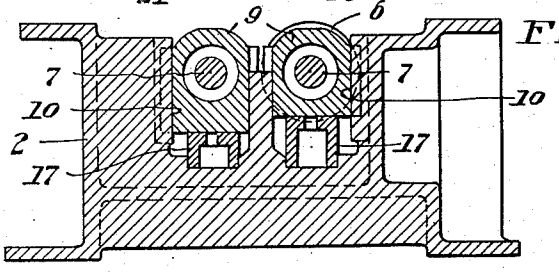


Fig. 6.



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UNITED STATES PATENT OFFICE

2,206,759

CROSS ROLLING

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Application August 11, 1938, Serial No. 224,306

5 Claims. (Cl. 29—13)

The present invention relates generally to the cold rolling of bars or rounds or the like, and more particularly to the straightening and sizing of such articles by cold rolling in machines of the cross-rolling type. By the present invention I provide an improved machine of the cross-rolling type for sizing and straightening bars, rounds or the like. The apparatus which I provide is such as to permit sizing and straightening of the material to a much greater extent and with greater ease than can be accomplished in any of the presently known cross-rolling machines. I have found that guide rounds, for example rounds which are within the usual hot rolled tolerances, may be readily sized and straightened so as to render them truly circular within a thousandth of an inch.

In my copending application Serial No. 88,159, filed June 30, 1936, I have shown and described a method and apparatus for cross-rolling rounds or the like for the purpose of sizing and straightening them. In the carrying out of the method and in the employment of the apparatus disclosed in said copending application some difficulty has heretofore been experienced in maintaining the rounds or the like in the roll pass. Where, as in the carrying out of the invention disclosed in the aforesaid copending application, the first roll pass consists of cross rolls having cylindrical material engaging faces there is a very definite tendency for the material to work to one side or the other of the roll pass. This condition is most prevalent where the center pass of the three passes is out of line with the other two passes for bringing about the desired straightening. When the rolls in the cylindrical pass are freshly ground and have not been used to a sufficient extent to cause appreciable wear, the material will be held in proper position in the roll pass but as the rolls begin to wear to an appreciable extent the tendency of the material to slide off the rolls becomes more marked. Side guides may, of course, be used to hold the material in proper position between the cross rolls but the use of side guides has been found unsatisfactory. The guides wear appreciably and the material is rendered nonuniform.

The present invention provides a solution to this problem of maintaining the rounds in proper position in the roll pass and constitutes a substantial improvement over the subject-matter of the aforesaid application.

In accordance with the present invention I provide a cross-rolling machine of the type disclosed in my aforesaid application. The one pass, preferably the first pass, is provided with rolls having cylindrical working faces and the succeeding passes are provided with rolls having concave working faces, the concavity of the rolls increasing progressively throughout the machine. For example, where three pairs of cross rolls are utilized the first pass may be cylindrical and the next two passes provided with cross rolls having concave working faces, the degree of concavity in the rolls of the last or third pass being greater than that of the rolls of the second pass. The second pass in a machine of this character is preferably adjustable so that it can be positioned out of line with the passes formed by the first and third pairs of cross rolls so as to provide for straightening of the material.

In accordance with my invention the rolls, which are provided with cylindrical working faces, are provided with shoulders immediately adjacent the cylindrical working face of each roll and these shoulders engage the material and prevent it from escaping from the pass.

In operation the first stand or pair of rolls provides point contact between the work piece and the rolls due to the fact that the working face is cylindrical. This point contact is conducive to flow of metal in the bar or round without any tendency to open it up at the center. The rolls of the second stand are slightly concave and this results in the rolls of this stand engaging the material over a greater length, but as the round has been previously worked upon by truly cylindrical rolls there is no tendency to open up the material at the center. The same is true with respect to the rolls of the third stand. By the time the material reaches this stand of rolls it has been previously subjected to working operations without any upsetting of the center thereof and the increased concavity of the third set of rolls will not cause rupture of the center of the material worked upon.

While my invention is not limited to any particular degree of concavity of the rolls of the second and third passes and while my invention is not limited to the use of any particular number of passes, I have found it desirable to make the rolls of the second and third passes of sufficient concavity to insure against any markings or spiral indentations on the material due to its passage through the first pair of rolls.

In the accompanying drawings I have shown for purposes of illustration only a mill embodying my invention. It will be understood, however, that my invention is not limited to the details disclosed in the drawings as they are to be considered as illustrative only.

In the drawings:

Figure 1 is a complete plan view of a mill embodying my invention;

Figure 2 is a horizontal section in the plane of the axis of the spindle of the lower rolls;

Figure 3 is a vertical sectional view taken along the line III—III of Figure 1;

Figure 4 is a vertical section taken along the line IV—IV of Figure 2;

Figure 5 is a vertical sectional view taken along the line V—V of Figure 1;

Figure 6 is a vertical sectional view taken along the line VI—VI of Figure 2;

Figure 7 is a plan view showing the arrangement of the rolls in the first pass; and

Figure 8 is a partial perspective view showing the first pass of the apparatus shown in Figure 1.

In the machine shown in the drawings the housing is formed in two parts, a lower portion 2 and an upper portion 3. The upper and lower portions of the housing are arranged and means provided therein for each supporting three of the cross rolls, that is, the upper portion provides supports for the three upper rolls and the lower portion provides supports for the three lower rolls. The parts are so arranged that the upper and lower portions of the housing may be entirely separated from each other along the pass line so as to permit ready access to the interior of the machine. Adjusting mechanism hereinafter more fully described is provided so that the lower rolls in each pair of cross rolls may be adjusted vertically for adjusting the pass to permit rolling of various sizes of rounds. Adjusting mechanism is also provided for the upper roll in the intermediate or idler pass so as to permit adjustment of the pass formed by the idler rolls relative to the pass formed by the other two pairs of rolls. This not only permits the adjustment of the size of the pass between the idler rolls but it also permits the adjustment of the pass formed by the two idler rolls relative to the line of travel of the material. This is of considerable advantage in the straightening of rounds.

The lower rolls 4 and 5 of the first and third passes, respectively, and the lower rolls 6 of the intermediate or idler pass are provided with necks 7 which are mounted in roller bearings 8 which are mounted in chock blocks 9 in windows 10 in the housing. One of the necks 7 on each of the lower rolls 4 and 5 is provided with a cruciform shaped portion 11 for connection to a spindle 12 by an ordinary wobbler connection 13. Each of the spindles 12 is arranged to be driven by a motor 14 through a pinion gear 15 and driven gears 16 for driving the roll.

Each of the rolls 4 and 5 may be adjusted vertically in the housing by means of a wedge 17 appropriately connected by a pin 18 to a threaded rod 19. Each rod 19 is threaded through a rotary block 20 mounted in the lower portion 2 of the housing. Each rotary block 20 is provided with a hand wheel 21 which is rigidly secured thereto so as to facilitate rotation of the block. Rotation of the block 20 will move the threaded rod 19 in one direction or another so as to appropriately raise or lower the roll by means of the wedge 17. A lock nut 22 is threaded on the outer end of each rod 19 so as to prevent relative movement between the threaded rod 19 and the threaded block 20 when it is desired to hold the roll pass in any adjusted position.

The idler roll 6 is not provided with a cruciform end portion as it is preferably not connected to driving mechanism such as that utilized for driving the rolls 4 and 5. However, adjusting means identical with that above described for adjusting the rolls 4 and 5 is provided for the idler roll. In view of the fact that the adjusting mechanism for the idler roll is the same as that shown for the driven rolls 4 and 5 it will be unnecessary to specifically describe it herein.

The upper rolls 23 and 24 in the first and third passes, respectively, are driven as are the lower rolls in these passes. The upper roll 25 in the intermediate pass is not driven. The upper roll 25 is provided with necks 26 which are mounted in roller bearings 27 mounted in chock blocks 28 in windows 29 in the upper portion 3 of the housing. The chock blocks are provided with recessed portions 30 adapted to cooperate with supporting rods 31 extending upwardly through openings 32 in the housing. Springs 33 are provided adjacent the upper end of the supporting rods 31 and one end of each spring is adapted to bear against a bearing block 34 carried by the housing. The upper end of each of the springs 33 is adapted to cooperate with a cup-shaped member 35 which is held in position over each spring by appropriate nuts 36 threaded on the upper threaded ends of the rods 31.

In order to permit of appropriate vertical adjustment of the roll 25 so as to permit adjustment of the intermediate pass relative to the pass formed by the other two pairs of rolls, a wedge 37 is interposed between the chock blocks and the housing, which wedge may be moved in one direction or another in order to raise or lower the roll. The wedge 37 is connected by a pin 38 to a rod 39 having a threaded portion 40 threaded in a rotary block 41 carried by the housing. The rotary block 41 is provided with a hand wheel 42 for facilitating rotation thereof and for effecting movement of the rod 39 in one direction or another for adjusting the roll. A lock nut 43 maintains the wheel 42 in any adjusted position.

The upper driven rolls 23 and 24 are mounted in the upper portion 3 of the housing in a manner somewhat similar to the mounting for the intermediate roll 25 except that provision is not made for vertical adjustment of these rolls. As shown in Figures 1 and 5 the rolls 23 and 24 are provided with necks 50 and 51. The necks 50 and 51 are each mounted in appropriate roller bearings which in turn are mounted in chock blocks 52 mounted in windows 53 in the housing. These chock blocks are maintained in fixed position by means of bolts 54 which are held in position by nuts 55 and 56.

The necks 51 of the rolls 23 and 24 are provided with wobbler drive connections 57 for connection to spindles 58. The spindles 58 are driven by a motor 59 to a pinion gear 60 and driven gear 61. An appropriate connection 62 is provided between each of the spindles 58 and the shafts upon which the gears 61 are mounted.

Hinges 65 are mounted upon the upper and lower portions of the mill housing so that the upper portion may be swung upwardly to permit access to the rolls for examination and for replacement.

The spindles 58 which are utilized for driving the rolls 23 and 24 and the driving mechanism are arranged so that they lie along the axes of their respective rolls and also so that they are substantially parallel with each other. This arrangement permits of a greatly simplified driv-

ing mechanism for the rolls 23 and 24 may, by virtue of this arrangement, be driven from a common motor without an extensive gear train, the driving being effected by a single pinion 60 cooperating with driven gears 61 mounted on shafts which are connected directly to the wobblers. The same is true with respect to the drive for the lower rolls. In this connection the spindles 12 extend axially of the roll and substantially parallel with each other and may be readily connected by a very simple mechanism to a single driving motor.

The working face of each of the rolls 4 and 23 forming the first pass is substantially cylindrical. On each side of the working face of each of the rolls 4 and 23 shoulders 4' and 23' are formed for the purpose of preventing the material during the rolling operation from being forced out from between the rolls. The material as it passes between the rolls 4 and 23 engages the cylindrical working face of each of the rolls and the shoulders prevent any sidewise thrust of the material. As the material passes between the rolls 4 and 23 point contact is obtained between the working faces and the material sized. The rolls 6 and 25 forming the second pass have working faces which are slightly concave so that as the material passes between these rolls line contact is obtained between the roll faces and the material. As pointed out above these rolls are normally out of line with the rolls in the first and third pass and straightening thereby effected. In addition these rolls aid in rolling down any indentations placed on the material by the first pair of rolls. The rolls 5 and 24 forming the third pair are still more concave than the rolls in the second pass and as the material passes between these rolls the material is effectively smoothed.

I have found that where apparatus of the character which I have just described is employed bars, rods or the like may be sized and straightened as effectively and far more cheaply than can be obtained in a cold drawing operation. I have found that it is relatively easy to size and straighten guide rounds within their usual tolerances so that after being worked upon they will be truly circular within approximately one thousandth of an inch. I have also found that by this method of working the hardness and ductility of the material can be controlled.

My invention is not limited to the particular apparatus described above as it may be otherwise embodied within the scope of the appended claims.

I claim:

1. A mill for sizing and straightening rounds or the like, comprising a plurality of cross rolls arranged to form successive roll passes, the rolls in one pass having substantially cylindrical working faces and raised shoulders adjacent the cylindrical working faces and the working faces of the rolls in at least one of the succeeding passes being concave, and means for driving at least one pair of rolls.

2. A mill for sizing and straightening rounds or the like, comprising a plurality of pairs of cross rolls forming successive roll passes, the rolls in the initial pass having substantially cylindrical working faces and raised shoulders abutting said working faces, and the working faces of the rolls in the succeeding passes being concave and arranged to engage increasingly longer portions of the material, and means for driving at least one pair of the rolls.

3. A mill for sizing and straightening rounds or the like, comprising a plurality of pairs of cross rolls forming successive roll passes, the rolls in one of said passes having substantially cylindrical working faces and guiding shoulders abutting said working faces and the working faces of the rolls in at least one of the succeeding passes being concave, and means for driving at least one pair of rolls.

4. A mill for sizing and straightening rounds or the like, comprising a plurality of pairs of cross rolls forming successive roll passes, the rolls in one of said passes having substantially cylindrical working faces and guiding shoulders abutting said working faces and the working faces of the rolls in at least one of the succeeding passes being concave, means for driving at least one pair of rolls, and means for adjusting at least one cross roll in each pass relative to the other cross roll.

5. A mill for sizing and straightening rounds or the like comprising a plurality of pairs of cross rolls forming successive roll passes, the working faces of the cross rolls in one pair being substantially cylindrical and said rolls being provided with at least one shoulder abutting the working face, and the working faces of the cross rolls in a succeeding pair being concave.

PETTER B. ABRAMSEN.