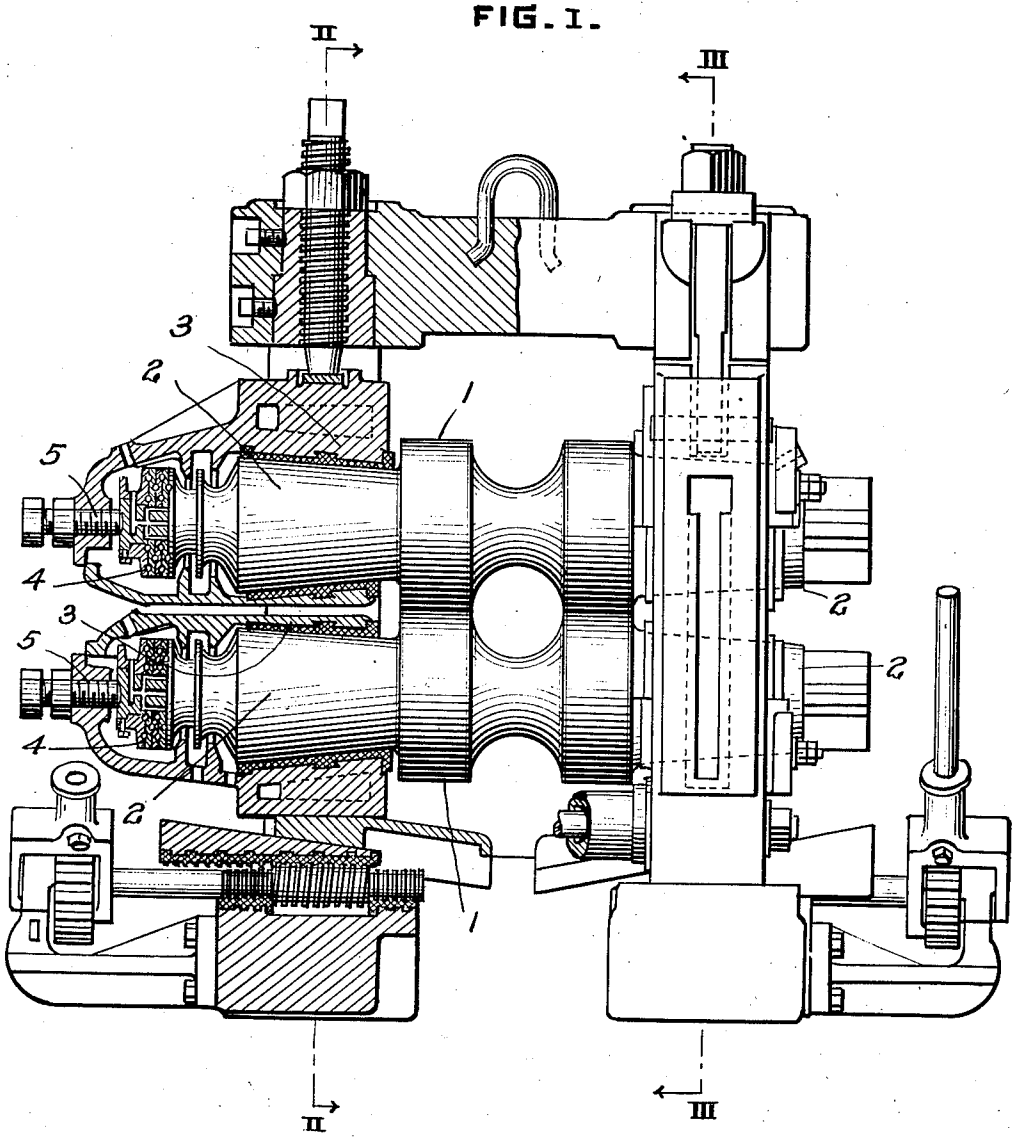
Aug. 3, 1926. 1,594,420

J. S. LOCHHEAD ET AL.

ROLLING MILL

Filed May 10, 1924 3 Sheets-Sheet 1

FIG. 1.



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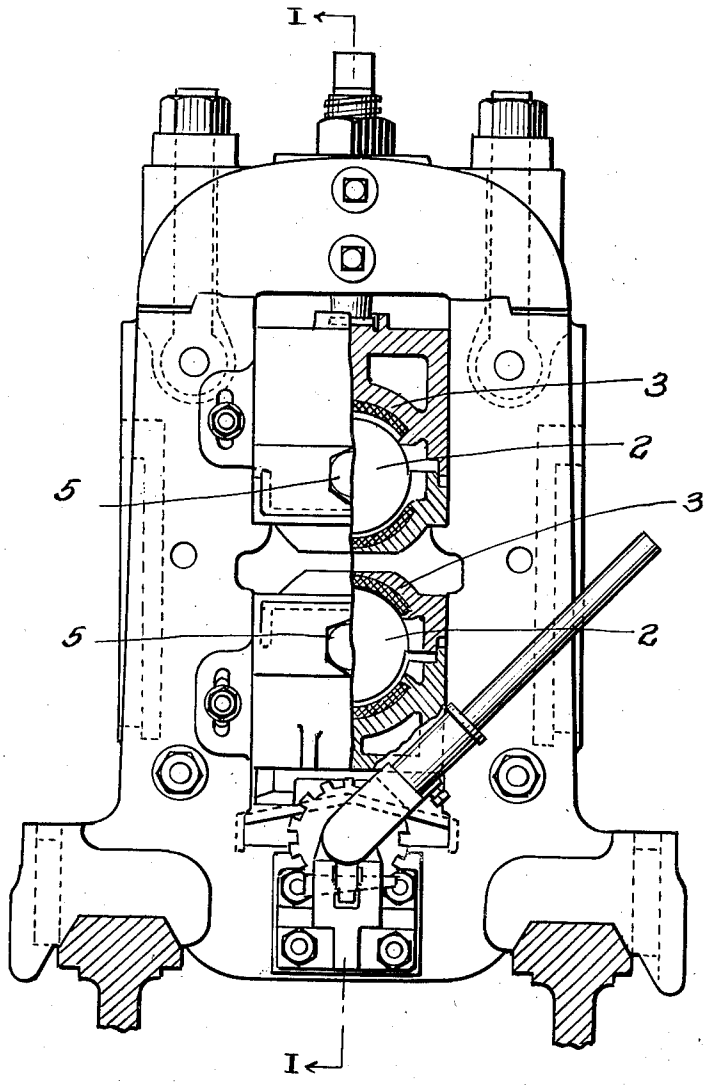
Aug. 3, 1926. 1,594,420

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ROLLING MILL

Filed May 10, 1924 3 Sheets-Sheet 2

FIG. II.



WITNESSES

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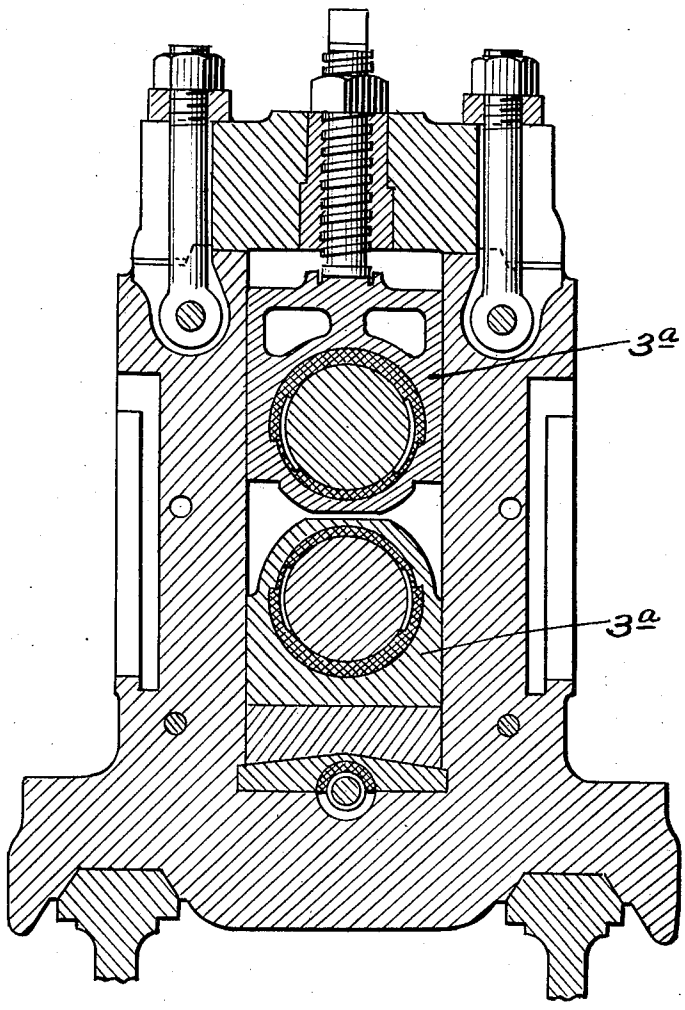
Aug. 3, 1926. 1,594,420

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ROLLING MILL

Filed May 10, 1924 3 Sheets-Sheet 3

FIG. III.



WITNESSES
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UNITED STATES PATENT OFFICE.

JAMES S. LOCHHEAD AND WARREN WORTHINGTON, OF PITTSBURGH, PENNSYLVANIA.

ROLLING MILL.

Application filed May 10, 1924. Serial No. 712,203.

Our invention relates to improvements in rolling mills, and while it is not necessarily so limited, we shall show and describe it in application to a rolling mill of which the component rolls are grooved in order to impose upon the rolled articles a particular shape in transverse section.

Fig. I of the accompanying drawing is a view partly in vertical and medial section and partly in side elevation of a rolling mill in which our invention is embodied. Fig. II is a view of the same mill partly in end elevation, partly in transverse section. The plane of section of Fig. I is in Fig. II indicated by a dotted line I—I, and the plane of section of Fig. II is in Fig. I indicated at II—II. Fig. III is a view in vertical section, on the plane indicated at III—III, Fig. I, and illustrating a modification.

The rolls of this mill which form the pass in which rolling is effected are indicated at 1. They are, as will be seen, grooved rolls with half-round grooves and they co-operate to roll round bars. A difficulty commonly experienced in mills of this nature for rolling such articles is the difficulty of maintaining the two rolls which constitute the roll-pass under all conditions and circumstances of rolling, in substantially exact corresponding position, to the end that the rolled articles shall, within permissible limits, be accurately round in cross-section. In the course of the operation of mills of this sort as commonly constructed, variations in the relative positions of the companion rolls occur, and these variations become so great in magnitude as to result in an imperfect and unsatisfactory product. These variations spring from the fact that as mills ordinarily are constructed, the rolls are held in alignment by means of two end-thrust collars upon each roll. These end-thrust collars are difficult to lubricate, the areas of their bearing upon the roll bodies are relatively small, grit and scale are prone to find their way between the surfaces of the bearings; and these circumstances, taken in connection with the fact that the rolls rotate at high speed, result in the mal-alignment alluded to, with results, as has been said, which are liable to be unsatisfactory.

Our invention lies in recognizing the general tendency in the rolls of a rolling mill to shift longitudinally, and in providing that the tendency to shift, always present, instead of being irregular in its occurrence and uncertain in its value, shall be ordered: specific provision is made, not to diminish it, but to magnify it and make it certain. Then, additionally, means are provided for resisting the tendency to shift, to the end that the positions of the rolls, both absolutely and relatively, may at all times be under control. We further provide that the means last named, that is to say, the means for resisting the shift, shall be adjustable. Thus our invention involves not merely means for preventing the roll shift, but means which, allowing roll shift, shall control roll shift and limit it to such an extent as to insure proper alignment, and no more. In other words, both of the rolls of the mill in which our invention is embodied are, while under the strain of the rolling operation, subject to a tendency to shift in a common direction, and while so subjected to a shifting tendency, they are at a certain point positively restrained against further shifting.

Turning from this general characterization to the specific construction illustrated in the drawings, the two rolls, 1, 1, are provided with tapered necks, 2, 2, and are carried in bearings 3, 3, which are correspondingly tapered. These tapered necks with correspondingly tapered bearings may be provided at one end of the mill only, but preferably they are provided at both ends, as is clearly indicated in the drawings. If provided at both ends, the arrangement will, as shown in Fig. I be that the taper shall at both ends of each roll, slope in the same direction. In the employment of the invention as we here have worked it out, the taper of the necks of the two rolls is in the same direction, and that is the arrangement which we preferably employ, if only for the sake of simplicity in the general arrangement of the mill.

Having thus far disclosed our invention in its specific embodiment, we pause to remark, that, with a mill so constructed, when the rolling operation is in progress, the strains of rolling which tend to separate the rolls one from another, express themselves in a tendency of the rolls to shift longitudinally in the direction opposite to the direction of the taper, that is to say, from right to left, as seen in Fig. I. Stated in other words, the forces of rolling are resolved by the bearing of the oblique surfaces of the bodies

2, 3, one upon another, and the horizontal component of this resolution of forces tends to shift the rolls from right to left.

Opposite the ends of the rolls, and specifically opposite the ends towards which the rolls tend to move, we arrange thrust-bearings 4. The specific construction of these thrust-bearings is not important to our invention. Suffice it to say that as here shown they are of familiar type, consisting of superposed layers of different material, properly lubricated, the whole, of course, being suitably backed. We preferably also make these thrust-bearings adjustable, as by the set-screws 5.

It will immediately be perceived that, by the provision of these tapered necks for the rolls with their correspondingly tapered bearings and with the consequent tendency to a longitudinal shifting of the rolls, and by the further provision of thrust-bearings arranged to resist such shifting, we can so control the position of the rolls minutely as to bring them accurately to alignment. Furthermore, throughout all the progress of the rolling operation, to the extent that tendency to mal-alignment develops, we can without disturbance of the assembly, and without disturbance of mill operation, and in most effective manner, reestablish the desired alignment.

In the foregoing description we have dwelt particularly upon the tendency of the rolls provided with tapered necks when under the strain of rolling, to shift in one direction, the direction, namely, from right to left as viewed in Fig. I.

We now further remark that, although the vertical strains of rolling exerted upon the oblique bearing surfaces tend to produce displacement of the rolls in the direction just indicated, there are in practical operation and under working conditions, strains which are not truly vertical and strains which may tend in the opposite direction. These oppositely tending strains may be derived from the particular shape of the material itself or from the changes in shape of the roll body itself under wear. Our invention contemplates combining with the features already described other features which shall positively resist displacement of the roll bodies in left-to-right direction (with reference to Fig. I). We here refer particularly to Fig. III, where a permissible modification in structure is illustrated. The bearing blocks 3^a, instead of being formed each in two pieces, as are the bearing blocks 3 as shown in Fig. II, and as already described, are one-piece structures. These one-piece blocks afford positive stop on the right, and the end-thrust bearings already described afford positive stop on the left. Thus the positioning of the rolls is wholly subject to control. It will be understood that Fig. III illustrates merely a permissible modification, and that if in a given installation this modification be not desired, the bearings at both ends of the rolls will be the two-piece bearings shown in Fig. II.

Incidentally, we find it desirable wholly to encase the bearings, as is best shown at the left-hand end, Fig. I. This complete encasement affords improved facilities for lubrication, as will be perceived by anyone acquainted with this subject. Scale and water are excluded, and loss of lubricant is prevented.

We do not mean to limit ourselves to a mill for rolling any particular material, or any particular shape, nor to roll bodies of any particular configuration, nor do we limit ourselves to any particular arrangement of the means employed for achieving the end desired.

We claim as our invention:

1. In a rolling mill and in combination with a roll thereof, means rendered effective by the strain of rolling, tending to shift the said roll longitudinally, and means for resisting such longitudinal shifting.

2. In a rolling mill and in combination with a roll thereof, means rendered effective by the strain of rolling, tending to shift the said roll longitudinally, and adjustable means for resisting such longitudinal shifting.

3. In a rolling mill the combination with a roll having a tapered neck, of a correspondingly tapered bearing, and means for resisting longitudinal movement of the roll in its bearings.

4. In a rolling mill the combination with a pair of rolls having tapered necks, of correspondingly tapered bearings, and a thrust-bearing for each roll adapted to resist longitudinal movement of the roll in its bearings.

5. In a rolling mill the combination with a roll having a tapered neck of a one-piece bearing block for said roll neck at one end and a thrust-bearing for the roll at its opposite end, the large end of said tapered bearing being toward said thrust-bearing.

In testimony whereof we have hereunto set our hands.

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