No. 835,505. PATENTED NOV. 13, 1906.

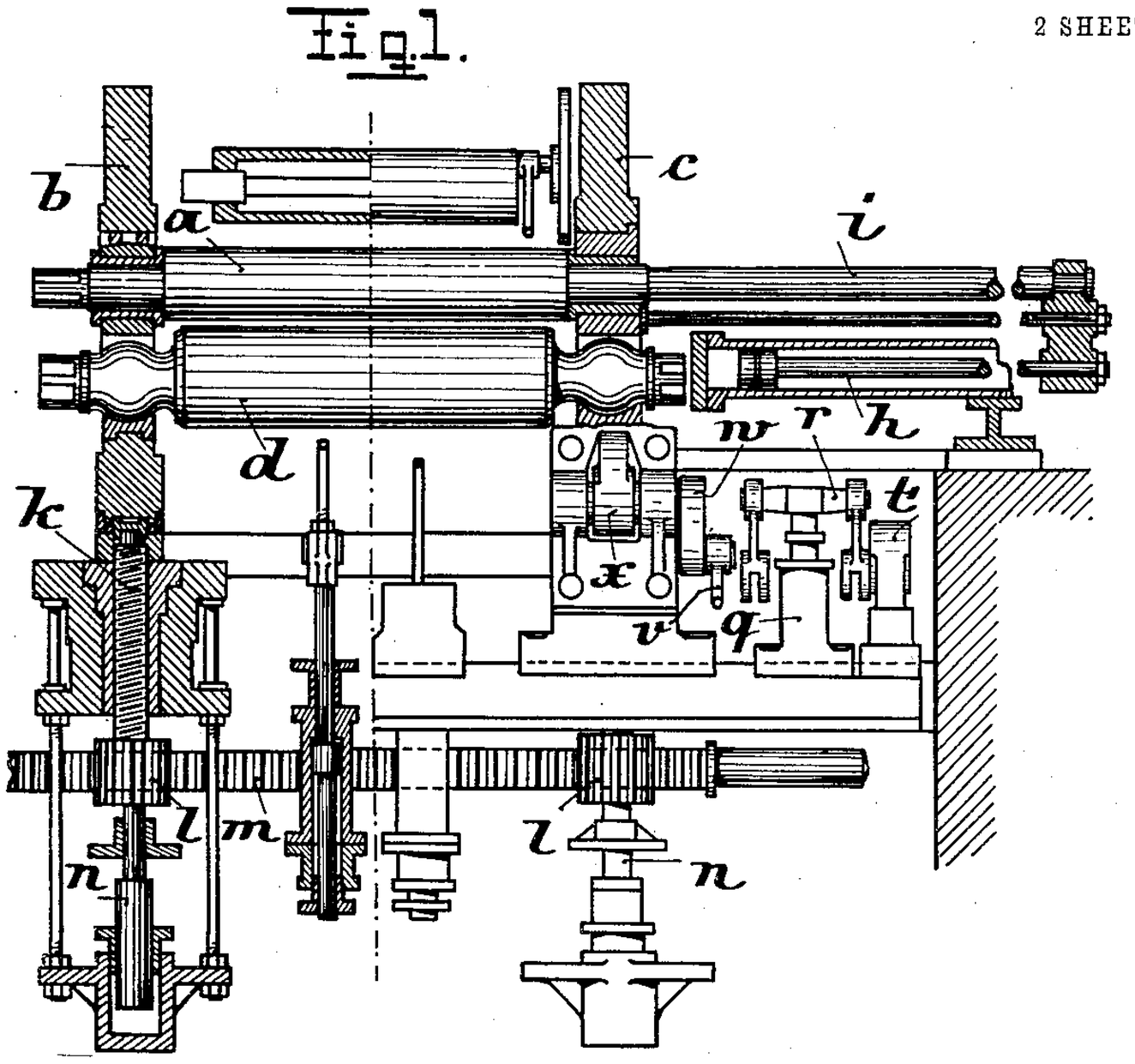
H. EHRHARDT.

CYLINDER ROLLING MILL.

APPLICATION FILED MAR. 4, 1902.

2 SHEETS—SHEET 1

Fig. 1.



WITNESSES

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2 SHEETS—SHEET 2.

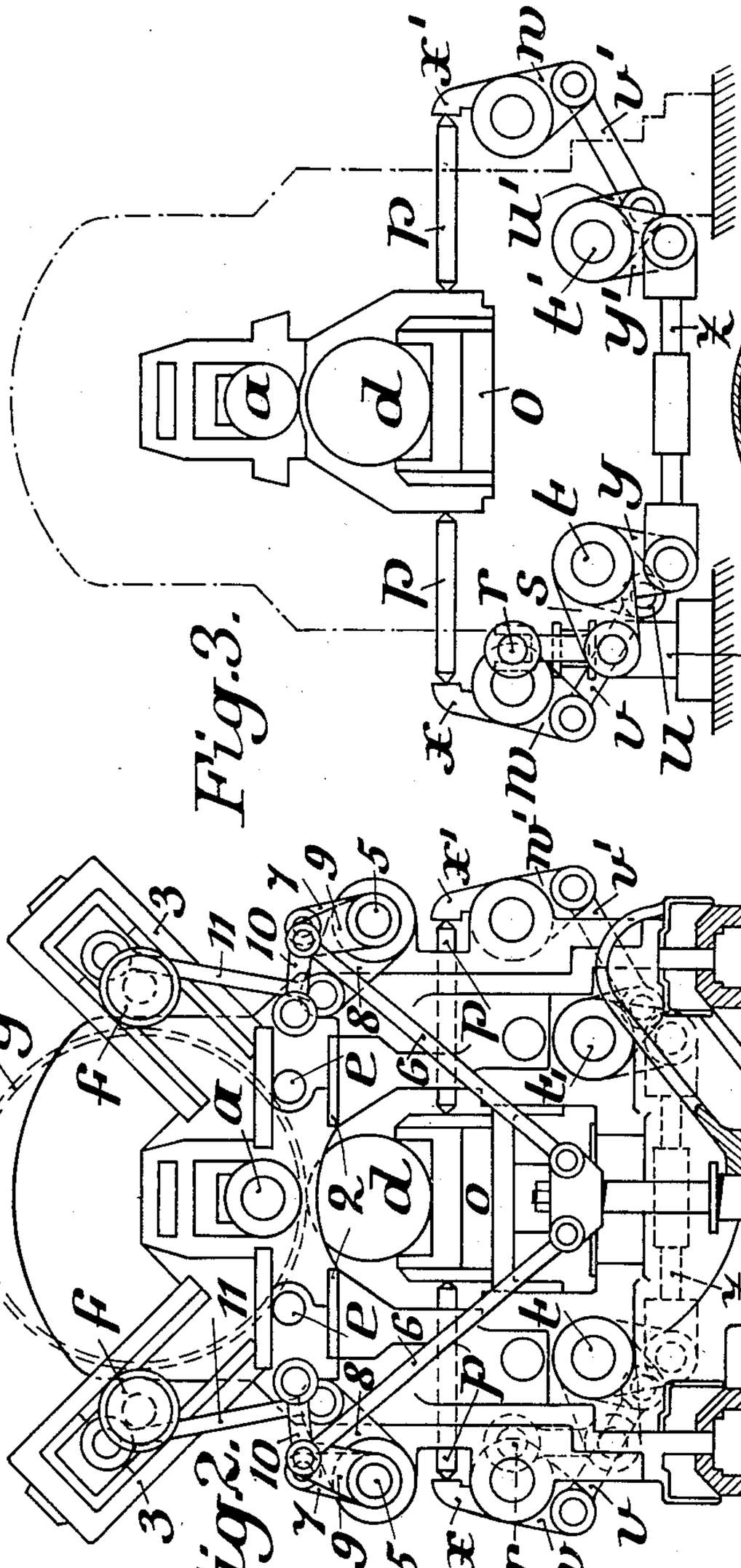

Fig. 3.

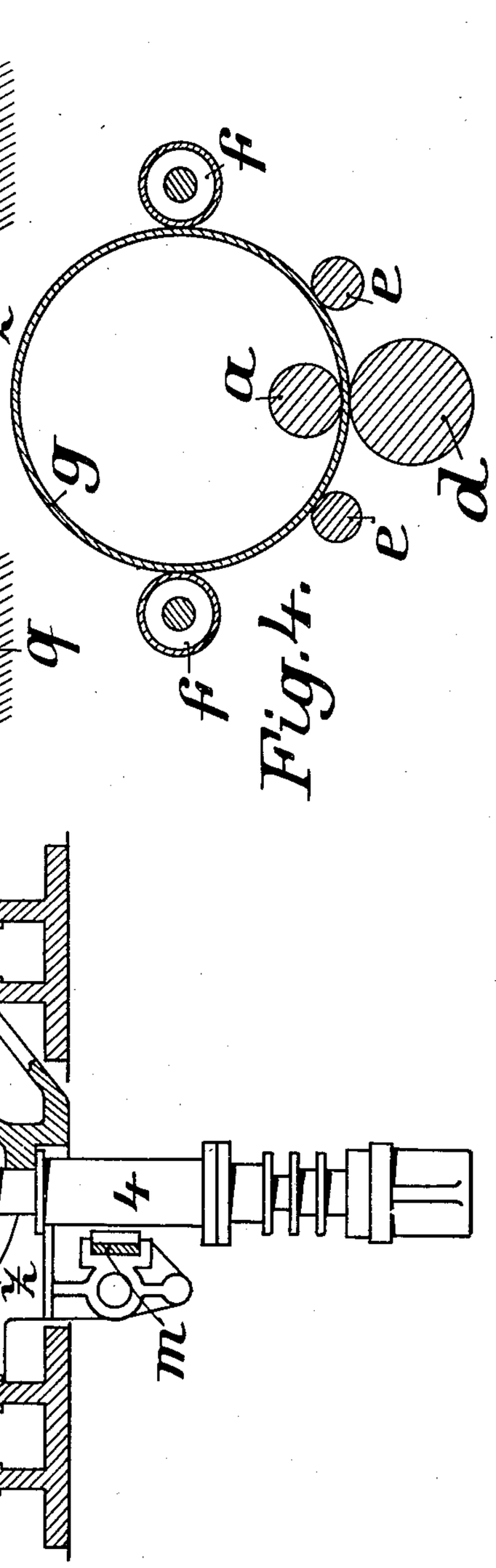

Fig. 4.

Fig. 2.

WITNESSES

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HEINRICH EHRHARDT, OF DÜSSELDORF, GERMANY.

CYLINDER-ROLLING MILL.

No. 835,505. Specification of Letters Patent. Patented Nov. 13, 1906.

Application filed March 4, 1902. Serial No. 96,584.

To all whom it may concern:

Be it known that I, HEINRICH EHRHARDT, engineer, a subject of the German Emperor, residing at 20 Reichstrasse, Düsseldorf, in the Empire of Germany, have invented new and useful Improvements in Cylinder-Rolling Mills; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a rolling-mill for rolling seamless hollow cylinders of large diameter; and it consists in the arrangement of the rollers so that the upper one may be withdrawn for introducing the blank and the lower one may be adjusted during the rolling operation. Guide-rollers for the blank are also provided and may be adjusted to the increasing diameter of the cylinder.

In the accompanying drawings, Figure 1 is a longitudinal vertical section through a mill constructed according to the invention showing a part in elevation. Fig. 2 is an end elevation partly in section. Fig. 3 is a similar view with parts of the mechanism removed, and Fig. 4 is a diagrammatic section through the blank and the rollers.

As shown in Fig. 1, the upper roller *a* is journaled in the standards *b* and *c* in such a manner that it can be withdrawn in the direction of its axis in order that the blank may be placed in position on the lower roller *d* and the guide-rollers *e e f f*. For this purpose the upper roller *a* is connected with a rod *i*, fastened to the piston-rod *h* of a hydraulic cylinder. By forcing the piston of the hydraulic cylinder by means of hydraulic pressure in a well-known manner to the right, the upper roller *a* will be withdrawn from the standards *b* and *c*. Then the blank *g*, Fig. 2, is placed on the lower roller *d* and the guide-rollers *e e f f*, whereupon the upper roller *a* is replaced into its standards by passing it through the hollow blank *g*, Fig. 2.

The bearings of the lower roller *d* are supported on screw-spindles *k* in such a manner that they may be adjusted to press the lower roller against the blank, and at the same time they are adapted to slide in a direction normal to the axis of the rollers *a* and *b*. For exerting the actual pressure on the blank without involving the screw-friction of the spindles, the latter are supported by hydraulic presses *n*, which exert the necessary pressure, but only to an extent determined by the adjustment of the screw-spindles. In order that the pressure shall always be the same at each end of the roller, each spindle *k* carries a pinion *l*, engaging with a toothed rack *m*, which is moved by any suitable mechanism. By this arrangement the adjustment of each spindle is the same. Any other of the known methods for making a driving connection between two shafts may of course be substituted for the rack and pinions.

Differences in the thickness of the wall of the cylinder that is being rolled caused, for instance, by the bending of one of the rollers, particularly the lighter upper one, are avoided by mounting the lower roller so that it can swing in a horizontal plane obliquely to the upper roller. The axis on which this turning occurs may be either the vertical line bisecting the length of the roller, so that the latter become closer together at their middle than at their ends, or a vertical line through one end of the lower roller. The arrangement for this purpose is more particularly shown in Fig. 3. The bearings *o* of the lower roller *d* can be shifted in the frame of the machine in directions at right angles to the axis of the roller, two axially-sliding pins *p*, one on each side of the bearing, being provided for the purpose.

The piston of a hydraulic press *q*, fastened to the stand of the machine, as shown in Figs. 1 and 3, has a cross-head *r* linked to an arm *s* on rocking shaft *t*. A second arm *u* on the latter is linked by a rod *v* with an arm *w* of a lever, which has a second arm *x* bearing against the end of the pin *p*. By raising the piston of the press *q* the lever *x* is caused to push the pin *p* to the right and at the same time the movement is transmitted by arm *y*, rod *z*, and levers *y' u' v' w'*, similar to those just described, to lever *x'*, which is thus shifted also to the right to allow of a like movement of pin *p* on that side of the bearing *o*. The rocking shafts *t t'* extend to the other end of the machine, where by a like system of levers they transmit the motion of the hydraulic press to the other bearing of the lower roller; but here the movement is in the opposite direction. If the lower roller is to swing about an axis passing through one of its ends, the bearing at that end is fixed and the pins *p* at the same end are removed, so that the levers *x x'* at this side of the machine cannot affect the roller-bearing.

Referring to Fig. 2, the arrangement for

adjusting the guide-rollers *e* and *f* to suit the increasing diameter of the cylinder comprises guides 2 and 3, in which the bearings of rollers *e* and *f* respectively slide, movement being imparted to them by a system of levers and a hydraulic press 4. By raising this press two rock-shafts 5 are rocked by means of links 6, Fig. 2, connected with the piston-rod of the press 4 and attached to arms 7, fastened on the rock-shafts 5. The movement of this rock-shaft is imparted by means of arms 8 and 9 and by means of links 10 and 11 to the rollers *e* and *f*, so that by raising the press 4 the rollers *e* and *f* are shifted outward in their guides to allow the cylinders *g* more room.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In a cylinder-rolling mill, the combination of a cylindrical roll adapted to support the cylinder to be rolled and to operate upon the exterior surface thereof, a second cylindrical roll adapted to operate upon the interior of the cylinder to be rolled, the operative portions of each roll being of uniform cross-section and of such length as to extend throughout the entire length of the cylinder, means for adjusting one end of the supporting-roll laterally so that said supporting-roll will extend obliquely to the interior roll, and means for holding said exterior roll in its adjusted position.

2. In a cylinder-rolling mill, the combination of a cylindrical roll adapted to support the cylinder to be rolled and to operate upon the exterior surface thereof, a second cylindrical roll adapted to operate upon the interior of the cylinder to be rolled, the operative portions of each roll being of uniform cross-section and of such length as to extend throughout the entire length of the cylinder, means for adjusting both ends of the supporting-roll laterally, but in opposite directions, so that said roll will extend obliquely to the interior roll, and means for holding the supporting-roll in its adjusted position.

3. In a cylinder-rolling mill, the combination of a roll adapted to support the cylinder to be rolled and to operate on the exterior surface thereof, a second roll adapted to act on the interior of the cylinder to be rolled, the operative portion of each roll being of uniform diameter throughout its length and adapted to extend throughout the cylinder to be rolled, means for adjusting laterally the exterior, supporting, roll so that said supporting-roll will extend obliquely to the interior roll, and means for holding said exterior, supporting, roll in its adjusted position.

4. In a cylinder-rolling mill, the combination of a roll adapted to act on one surface of a tubular blank, a second roll adapted to operate on the other surface of said blank, the operative portion of each of said rolls being of the same diameter throughout its length, means for adjusting one of said rolls laterally to cause it to extend obliquely to the other roll, and means for holding said movable roll in its adjusted position.

5. In a cylinder-rolling mill, the combination of a roll for acting on the interior of a cylinder, a roll for acting on the exterior of a cylinder, pins or rods arranged on opposite sides of a bearing of the exterior roll, and means for adjusting said pins or rods longitudinally to shift said bearing of the exterior roll laterally.

6. In a cylinder-rolling mill, the combination with a roll, of a laterally-sliding bearing supporting one end of the roll, levers arranged on opposite sides of said sliding bearing, means for simultaneously rocking said levers in opposite directions, and means for transmitting the motion of said levers to said bearing.

7. In a cylinder-rolling mill, the combination of a roll for acting on the interior of a cylinder, a roll for acting on the outer surface of a cylinder, the bearings of said outer roll being adjustable both vertically and laterally, hydraulic devices for adjusting said bearings laterally, and independent hydraulic devices for adjusting said bearings vertically.

8. In a cylinder-rolling mill the combination of a roll for acting on the interior of a cylinder, another roll for acting on the exterior of a cylinder, means for adjusting both ends of the second roll laterally in opposite directions, means for retaining said roll in its adjusted position, a pair of hydraulic cylinders, longitudinally-adjustable connections between the bearings of said exterior roll and plungers in said cylinders, and positively movable connections between said plungers, whereby the exterior roll can be adjusted toward or from the interior roll and the extent of such adjustment can be kept equal on both ends of the roll independently of any variation in the stroke of the plungers of the hydraulic cylinders.

9. In a cylinder-rolling mill, the combination of a roll for acting on the interior of a cylinder, a second roll for acting on the exterior of a cylinder, guides arranged on opposite sides of and above the exterior roll, a plurality of supplemental rolls mounted in said guides and acting with said exterior roll to support the cylinder being rolled, two rock-shafts arranged on opposite sides of said main rolls and each connected with the adjacent supplemental roll, and a power device adapted to simultaneously rock both said shafts to adjust the supplemental rolls as desired.

10. In a cylinder-rolling mill, the combination of a horizontal roll for acting on the interior of a cylinder, a second horizontal roll for acting on the exterior of a cylinder,

horizontal guides arranged on opposite sides of said rolls, oppositely-inclined guides arranged above said horizontal guides, supplemental rolls mounted in guides and acting with said exterior roll to support the cylinder being rolled, rock-shafts arranged on opposite sides of the main roll and each connected with supplemental rolls in the adjacent horizontal and inclined guides, and a power device adapted to simultaneously rock said shafts to adjust the supplemental rolls as desired.

In witness whereof I have hereunto set my hand in presence of two witnesses.

HEINRICH EHRHARDT.

Witnesses:

PETER LIEBER,

WILLIAM ESSENWEIN.