(No Model.) 2 Sheets—Sheet 1.

J. OSTRANDER.

ROLLING MILL.

No. 253,754. Patented Feb. 14, 1882.

Fig. 1.

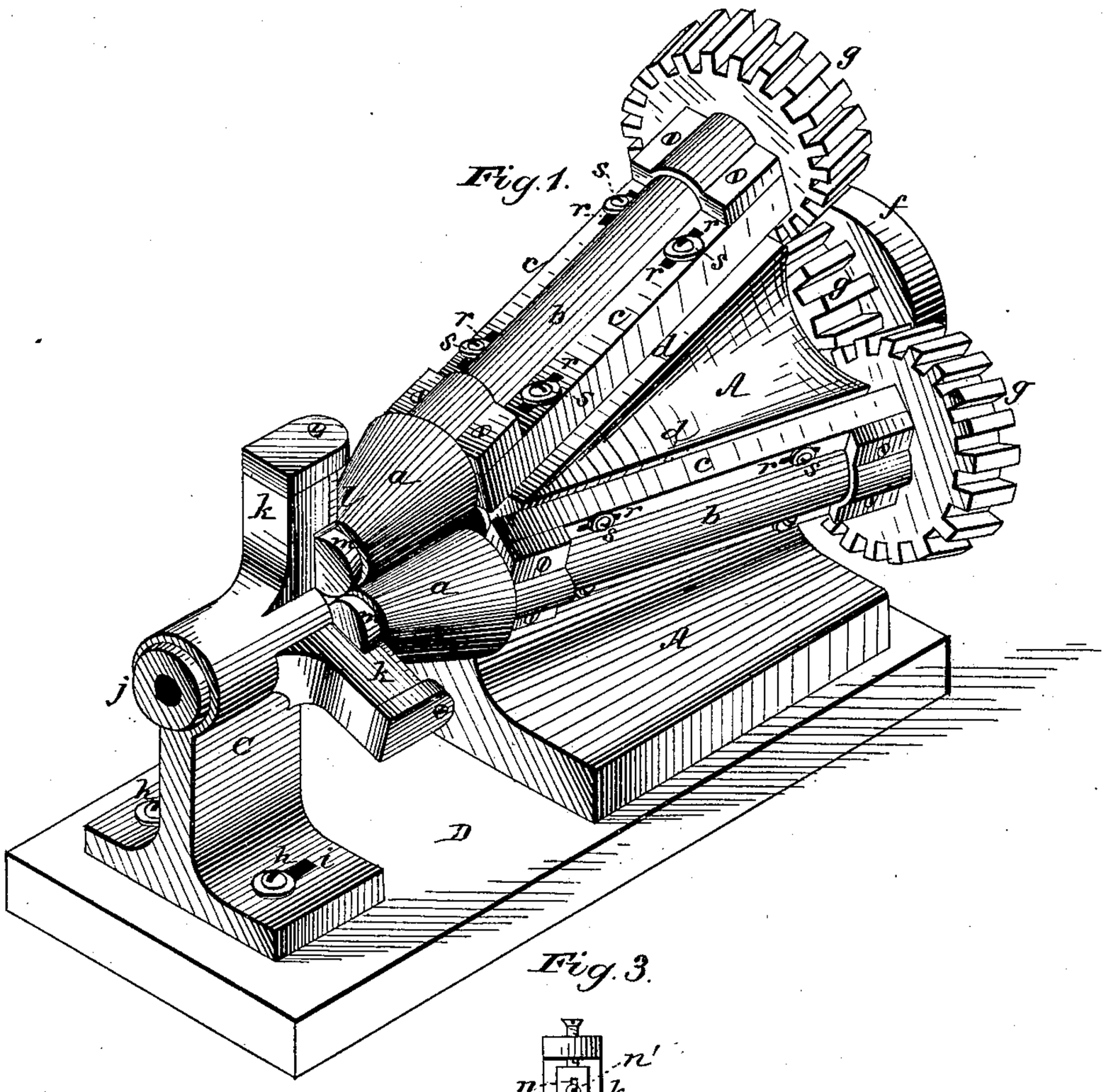
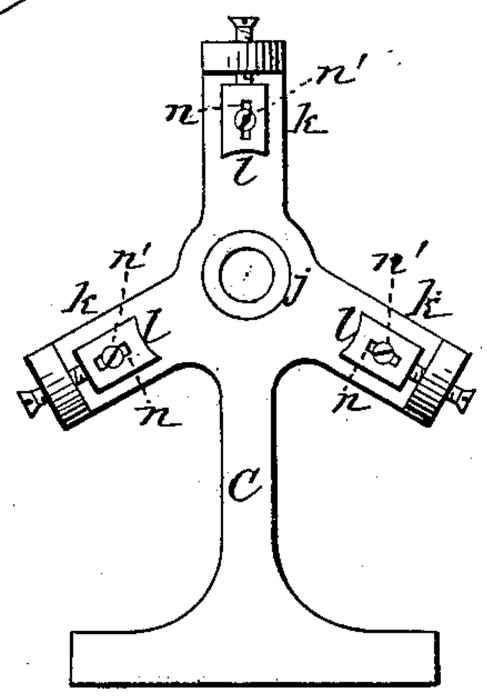


Fig. 3.



Witnesses.

Jas. E. Hutchinson.
Howell Bartle.

Inventor.

Jonathan Ostrander
by Johnson and Johnson
Attys

(No Model.) 2 Sheets—Sheet 2.

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Fig. 6.

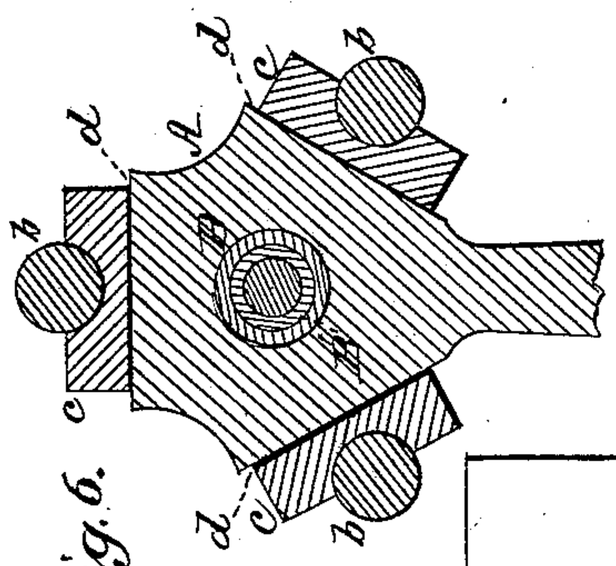


Fig. 2.

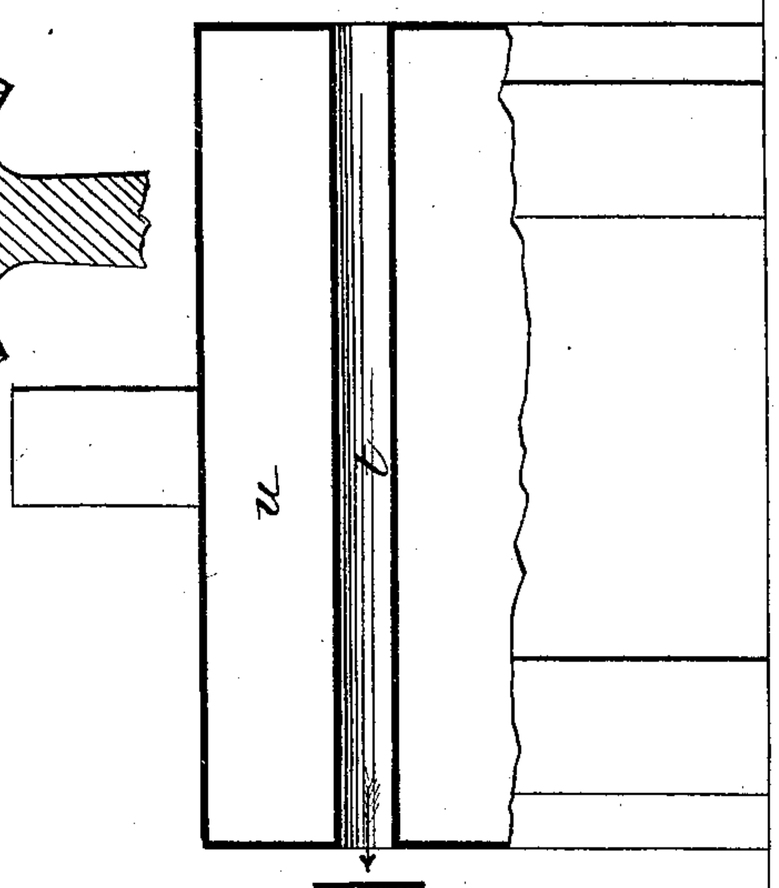


Fig. 1.

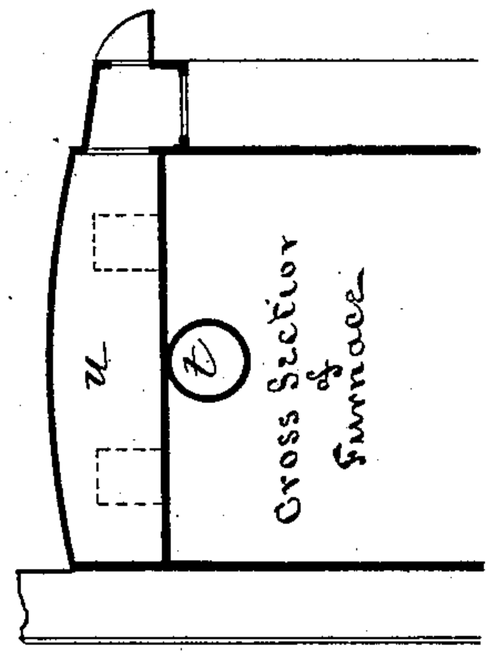


Fig. 4.

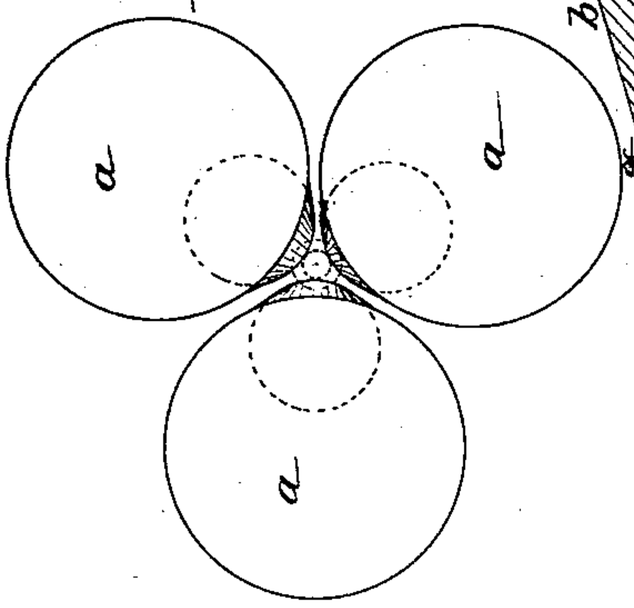


Fig. 3.

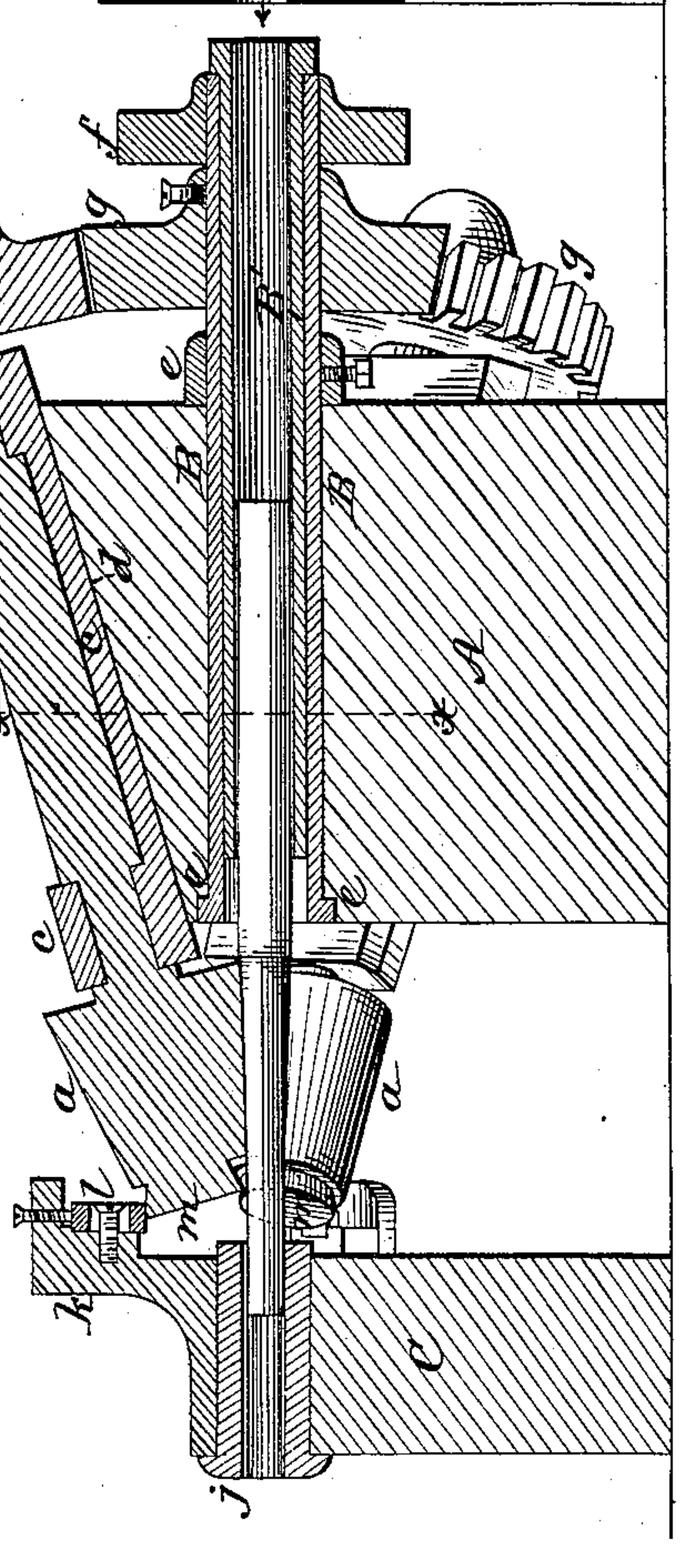
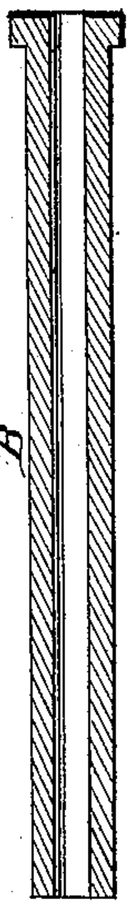


Fig. 5.



Witnesses.

Jas. E. Hutchinson.

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Inventor.

Jonathan Ostrander

by Johnson and Johnson

Attys.

UNITED STATES PATENT OFFICE.

JONATHAN OSTRANDER, OF WEST MIDDLESEX, PENNSYLVANIA, ASSIGNOR OF TWO-THIRDS TO JOSEPH W. RUSSELL, OF SAME PLACE, AND PHILLIP M. HAAS, OF YOUNGSTOWN, OHIO.

ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 253,754, dated February 14, 1882.

Application filed June 18, 1881. (No model.)

To all whom it may concern:

Be it known that I, JONATHAN OSTRANDER, a citizen of the United States, residing at West Middlesex, in the county of Mercer and State of Pennsylvania, have invented new and useful Improvements in Machines for Rolling Iron, of which the following is a specification.

The rolling-mill which I have improved is of the kind in which three rolls of tapering form are arranged in such relation to each other as to receive the article between them and feed it forward, compress it to the required diameter, and deliver it from the small ends of the rolls.

In my improved mill the rolls are arranged in triangular relation, their axial lines diverging from the same point, and form a central tapering space. The rolls are arranged outside of their housing-bearings to adapt them for longitudinal adjustment in relation to each other to produce rods or tubes of different sizes. This relation of the roll-surfaces serves to give a reducing, polishing, and finishing action upon the article operated upon by the roll-surfaces, to effect a certain and uniform feed of the article, and to produce a more satisfactory surface finish of the article. In connection with the endwise adjustment of the rolls to produce rods or tubes of different diameters, I provide interchangeable feeding and delivering tubes, whereby articles of different sizes are guided and firmly supported under the action of the rolls while being fed thereto and delivered therefrom. To resist the tendency of the rolls to spring at their free or non-journaled ends and to allow of their adjustment in the lines of their axes, I provide an adjustable tri-armed standard with adjustable abutments adapted to support the rolls and allow of their longitudinal adjustment to increase or diminish the tapering space between them. I combine with the mill a furnace for keeping the iron hot, and from which it is directly fed into the feeding-tube of the mill, the said furnace being provided with a heating-tube which forms a continuation of the feeding-tube of the mill. This gives important advantages in rolling iron as it comes from the bar-producing mill, in the matter of saving the expense and loss of time for reheating the iron, and especially for keeping the iron hot when reducing and polishing long bars by the taper rolls.

Referring to the accompanying drawings, Figure 1 represents a view in perspective of a rolling-mill embracing my improvements; Fig. 2, a vertical longitudinal section of the same, a bar of iron being shown as having been delivered to the mill direct from the heating-furnace and passing through the reducing and polishing rolls. Fig. 3 shows an elevation of the adjustable triangular-armed standard for supporting the tapering rolls at the ends from which the bar emerges. Fig. 4 shows the triangular relation of the rolls, showing the taper of the central space through which the rod is fed, reduced, and polished by the revolution of the rolls. Fig. 5 shows a longitudinal section of one of the interchangeable feeding-tubes, and Fig. 6 shows a cross-section of the rolls and their housing on the line *x x* of Fig. 2.

To enable those skilled in the art to which my invention relates to construct and use the same, I will particularly describe the construction and operation of my improved rolling-mill in connection with the drawings representing such construction.

The reducing and polishing rolls *a* are of tapering form, and are arranged so that their axial lines diverge from the same point, whereby their adjacent surfaces will form a tapering central passage for the bar or article under operation, that part of the bar between the rolls being in the form of a frustum of a cone. The rolls are carried by shafts *b*, secured in bearings in beds *c*, which are adjustably secured to a housing or housings, preferably of the construction shown, of a single casting, A, formed with flat-faced seats *d* for the beds *c*, diverging from the roll ends of said shafts in planes parallel with the axial lines of the rolls, whereby, in the longitudinal adjustment of the rolls to increase or diminish the space between their surfaces, such adjustment will maintain the taper relation of such roll-surfaces. The seats for the beds *c* are thus formed upon a support which gives a firm and solid bearing for the rolls. The rolls are carried outside of the housing or base with their larg-

est ends adjacent to the seats *c*, and the bar or tube is fed to and between the rolls through a horizontal central revolving tube, B, fitted in said base in line with the passage formed by the triangular relation of the rolls. By this construction the feeding-tube B for the article operated upon must always maintain the same central relation with the seats *c*, and necessarily the roll-surfaces must always work in the same relation to said tube. This feeding-tube B is fitted in the housing or base so as to be freely revolved therein, and is confined in position longitudinally by collars *e e*. The inner or delivering end of this tube may be flush with the housing, so as not to interfere with the longitudinal adjustment of the rolls; but its outer or receiving end must project a suitable distance to receive a pulley, *f*, or gear, by which said feeding-tube is operated by any suitable motor. This revolving feeding-tube is made the means of operating the reducing and polishing rolls through spur-gears *g* on the ends of the roll-shafts meshing with a similar gear on the projecting end of said feeding-tube. The rotation of this tube is in a direction opposite to that of the rolls, which are revolved together in the same direction, and which effects thereby the revolution of the article operated upon in the same direction as that in which the feeding-tube is revolved. While therefore the rolls are operated directly from the tube through which the article being treated is fed, the said tube is caused to revolve in the same direction in which the article is turned by the rolls, and thereby to cooperate not only in supporting and guiding the article in its passage to and through said rolls; but in reducing the friction of the article as it is drawn through the tube by the joint action of the tapering rolls. It will be understood that the taper form of the rolls, their relation to each other, and their revolution in the same direction effect the compound motion of the article—that is, a drawing movement through the central passage formed by the rolls and a rotary movement in the opposite direction to that of the rolls—so that all the parts revolve together in the operation of reducing the bar or tube and simultaneously polishing its surface. The arrangement of the rolls outside of the housings is important in allowing of their endwise adjustment, and as a long feeding-tube is thereby obtained, which supports the bar against vibration and holds it firmly under the action of the rolls.

The rotary feeding-tube which I have described is a permanent part of the mill, and for bars of the largest diameter which can be reduced by the rolls; but I provide for feeding and supporting smaller bars for operation by the same rolls (by reason of the capacity of the latter for adjustment) by means of tubes B′ of different interior diameters, Fig. 5, adapted to be fitted within the permanent tube B and to receive and support the article and to be revolved with it and with the permanent tube. In this way the feeding-tube is adapted to support articles of different diameters and to suit the adjustment of the rolls to properly reduce such articles.

In Fig. 4 I have shown the taper form of the space between the three rolls through which the bar is fed in being reduced, and in Fig. 2 I have shown in center section only the relation of the axial line of one of the rolls to the axial line of the bar being reduced. The axial lines of the other two rolls, however, have the same relation to the axial line of the bar. Referring now to the feed of the bar by the action of the rolls, I find that the speed of such feed is in proportion to the reduction of the bar—that is, a bar to be reduced, say, one-half its diameter will be fed through the rolls faster than a bar being reduced less than half its diameter. Should there be no reduction of the bar, there would be no griping action of the rolls tending to draw the bar in between them. The arrangement of the rolls so as to obtain a uniform action of their surfaces gives a better polished surface to the article and prevents unequal wear of the surfaces of the rolls.

A standard, C, is secured to the bed-plate D in front of the small ends of the rolls by means of screws *h*, passing through slots *i* in the base of said standard, by which it is made adjustable. This standard has an opening in line with the central opening formed by the rolls, and within which a tube, *j*, is fitted to receive and support the finished article as it is delivered from the rolls. This tube is made interchangeable for larger or smaller articles, so as to give proper support and steadiness as they are delivered from the rolls. This standard is formed with three arms, *k*, Fig. 3, corresponding to the positions of the rolls, and each arm is provided with an adjustable abutment, *l*, adapted to bear upon the outer side of hubs or shoulders *m*, formed upon the small ends of the rolls, and thereby resist their tendency to spring under their reducing action. The abutments are provided with slots *n*, by which they are adjusted radially to suit the adjustment of the rolls, and when set they are secured by screws *n′*, which serve to both clamp and set the abutments. As stated, the rolls are adjusted in the line of their axes to increase or diminish the working-space between them, and this adjustment is effected by setting their shaft-bearing beds lengthwise upon their housing-seats, the said bearing-beds for this purpose being provided with slots *r*, and clamped when set by screws *s* passing through said slots into said fixed seats. This method of adjusting the rolls preserves the regular taper relation of their working-surfaces, and as a consequence of such relation I obtain the full effect of the reducing and polishing action of the roll-surfaces and a certain and regular feed of the article by the action of the rolls. In this adjustment of the rolls they are set nearer to or farther from the end of the housing in lines diverging equally from the central feeding-tube, and to maintain the proper bear-

ing of the abutments upon the roll-hubs the tri-armed standard must be correspondingly adjusted. The rolls are of proper size, and preferably of polished steel. The roll-shafts may have intermediate bearings, if desired.

In rolling and rounding bars to reduce, polish, and finish them, such operation is usually continuous with the operation of the bar-producing mill, but is necessarily much slower than the latter operation, and the iron would become cooled as it is produced from the bar-mill and would require reheating before it could be passed through the forming and finishing mill. To avoid such reheating operation and the expense and delay attending it, I combine a heating-furnace with the mill. The furnace is provided with a heating-tube, *t*, which is in line with the feeding-tube B of the mill, and is placed in such close proximity to the receiving end of said feeding-tube that the article can be pushed out from the heating-tube *t* directly into the mill feeding-tube B, through which it is pushed until its end enters the rolls, when the latter operate to feed it forward. The furnace is provided with an oven, *u*, within which to keep the bars hot while waiting to be operated upon. The heating-tube and the oven are provided with end doors for retaining the heat. This furnace is also advantageous in keeping long bars at the proper heat, as the rear end would become cooled before the operation of rolling was finished. The mill, however, is adapted for rolling, polishing, and finishing metal rods, gun-barrels, and tubes, whether in a cold or heated state, and for short bars the furnace need not be used.

As the operation of reducing tubes is well understood in the art, it is unnecessary to describe such operation herein.

To permit of the removal of the feeding-tube and its replacement by another larger or smaller in its interior diameter, the bed-plate may be adapted to be turned in the manner of a turn-table to bring the receiving end of the feeding-tube to one side of the furnace when the latter is used as a co-operating means for heating and feeding the article to be rolled.

I claim—

1. As an improvement in mills for rolling metal articles of cylindrical form, the tapering rolls *a*, arranged with their axial lines diverging from the same point, forming a tapering space between their contiguous surfaces equal to the length of the rolls and in axial line with a feeding-tube, substantially as described, for the purpose specified.

2. In a rolling-mill for metal articles of a cylindrical form, the tapering rolls *a*, arranged with their axial lines diverging from the same point, forming a tapering space between their contiguous surfaces equal to the length of the rolls and in axial line with the feeding-tube, in combination with means whereby said rolls are adjusted in the line of their axes to increase or diminish the tapering space, substantially as described, for the purpose specified.

3. The rolls of a rolling-mill for metal articles of cylindrical form, arranged with their axial lines diverging from the same point, forming a tapering space between their contiguous surfaces equal to the length of the rolls and in axial line with the feeding-tube, in combination with the roll-bearing beds *c* and the housing A, to which said beds are adapted for adjustment with the rolls, substantially as described, for the purpose specified.

4. The rolls of a rolling-mill for metal articles of cylindrical form, arranged outside of their housing bearings or supports, with their axial lines diverging from the same point, forming a tapering space between their contiguous surfaces equal to the length of the rolls, in combination with a feeding-tube arranged within said housing, substantially as described, for the purpose specified.

5. The rolls of a rolling-mill constructed and arranged for adjustment and operation with a feeding-tube substantially as herein described, in combination with a tri-armed adjustable standard provided with adjustable abutments for supporting the non-journaled ends of the rolls, and with a delivering and supporting tube for the finished article, substantially as described, for the purpose specified.

6. In a mill for rolling metal articles of cylindrical form, the combination, with rolls arranged for adjustment and operation substantially as described, of a permanent tube and interchangeable feeding and delivering tubes having different interior diameters, adapted to suit different sizes of articles to be rolled, substantially as described.

7. The combination, in a mill for rolling metallic articles of cylindrical form, with the rolls arranged for adjustment and operation in relation to each other, and a feeding-tube arranged in central relation to said rolls, of a furnace having a heating-tube arranged in the relation to said feeding mill-tube substantially as described, for the purpose specified.

8. A mill for rolling metal articles of cylindrical form, consisting of rolls arranged with their axial lines diverging from the same point, forming a tapering space between their contiguous surfaces and adapted for adjustment in the line of their axes, a feeding-tube carried by the roll-housings, and a delivering-tube carried by an adjustable standard having adjustable abutments for supporting the non-journaled ends of said rolls, substantially as described, for the purpose specified.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JONATHAN OSTRANDER.

Witnesses:

his
MICHAEL × GALLIGHAN,
mark
JOHN H. ELLIOTT,
J. W. HAMILTON JOHNSON.