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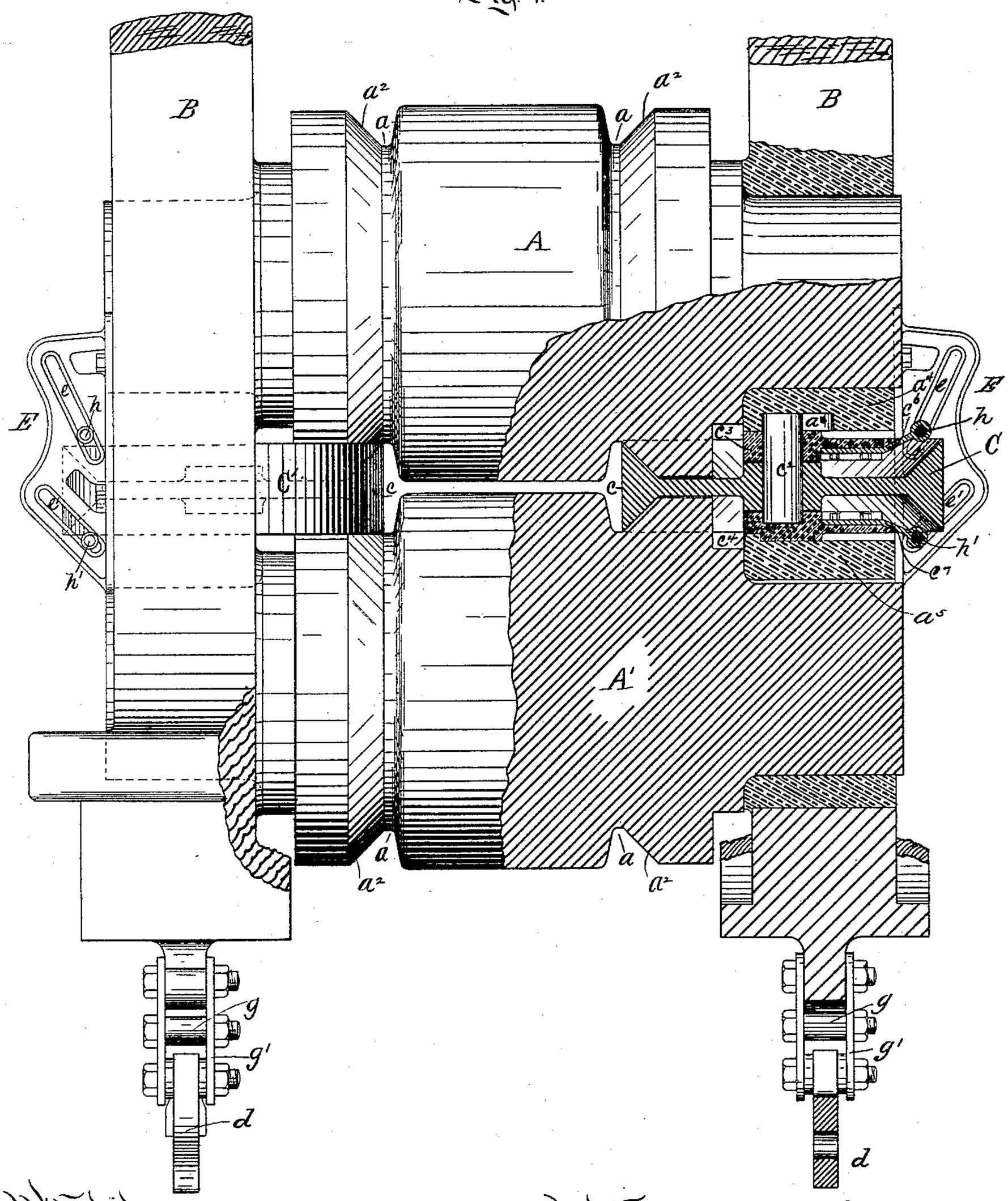
J. S. SEAMAN.

MACHINE FOR ROLLING BILLETS.

No. 318,513. Patented May 26, 1885.

Fig. 1.



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MACHINE FOR ROLLING BILLETS.

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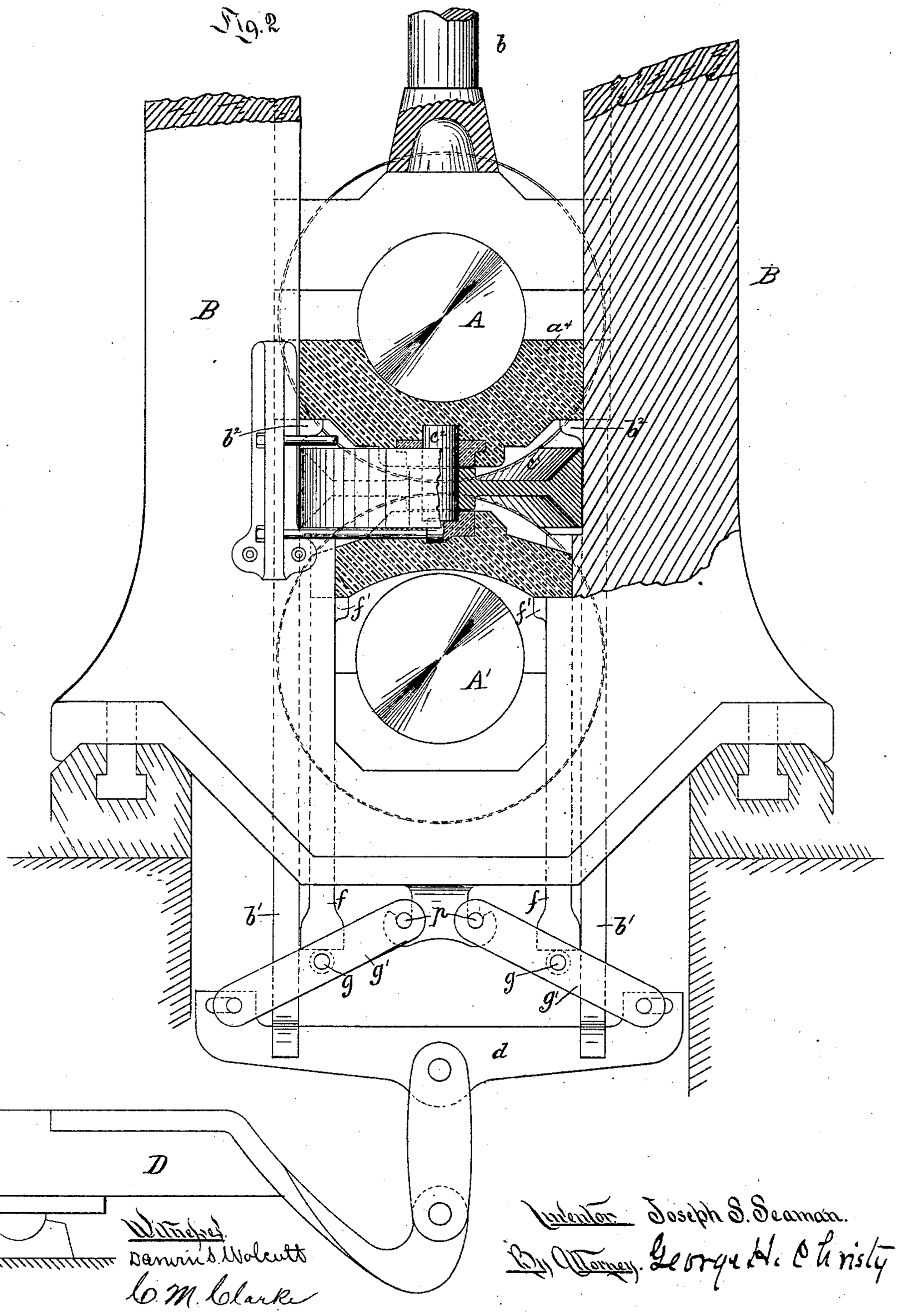

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J. S. SEAMAN.

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Fig. 3

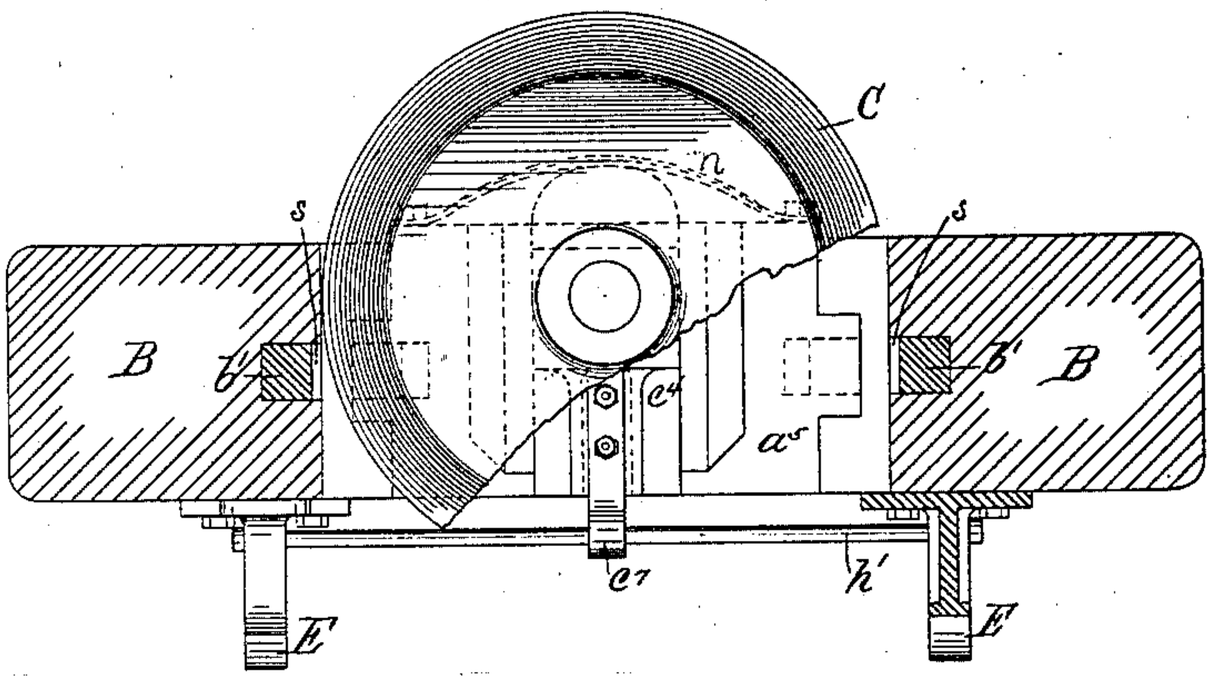
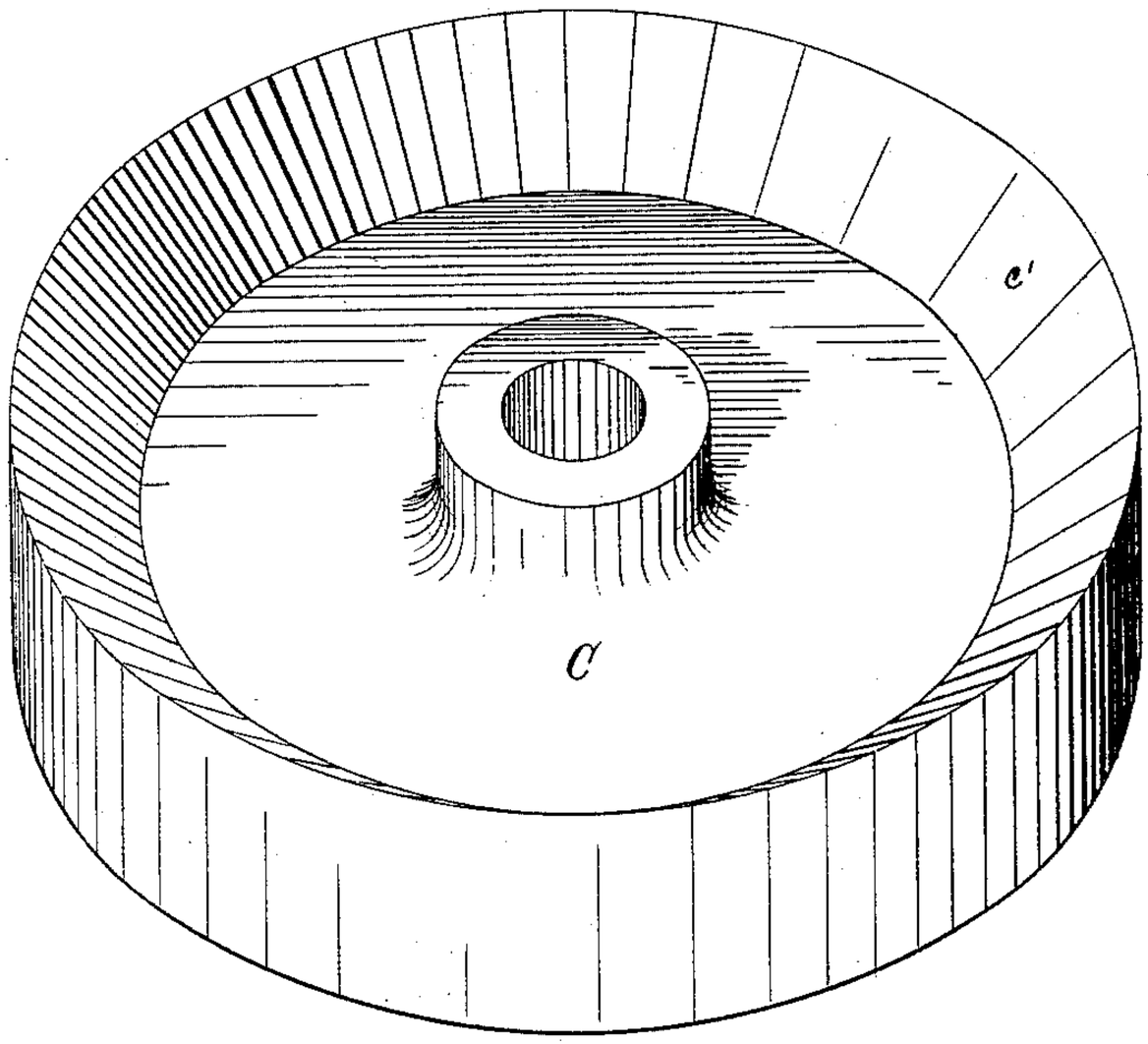


Fig. 4.



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(No Model.) 5 Sheets—Sheet 4.

J. S. SEAMAN.

MACHINE FOR ROLLING BILLETS.

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Fig. 5.

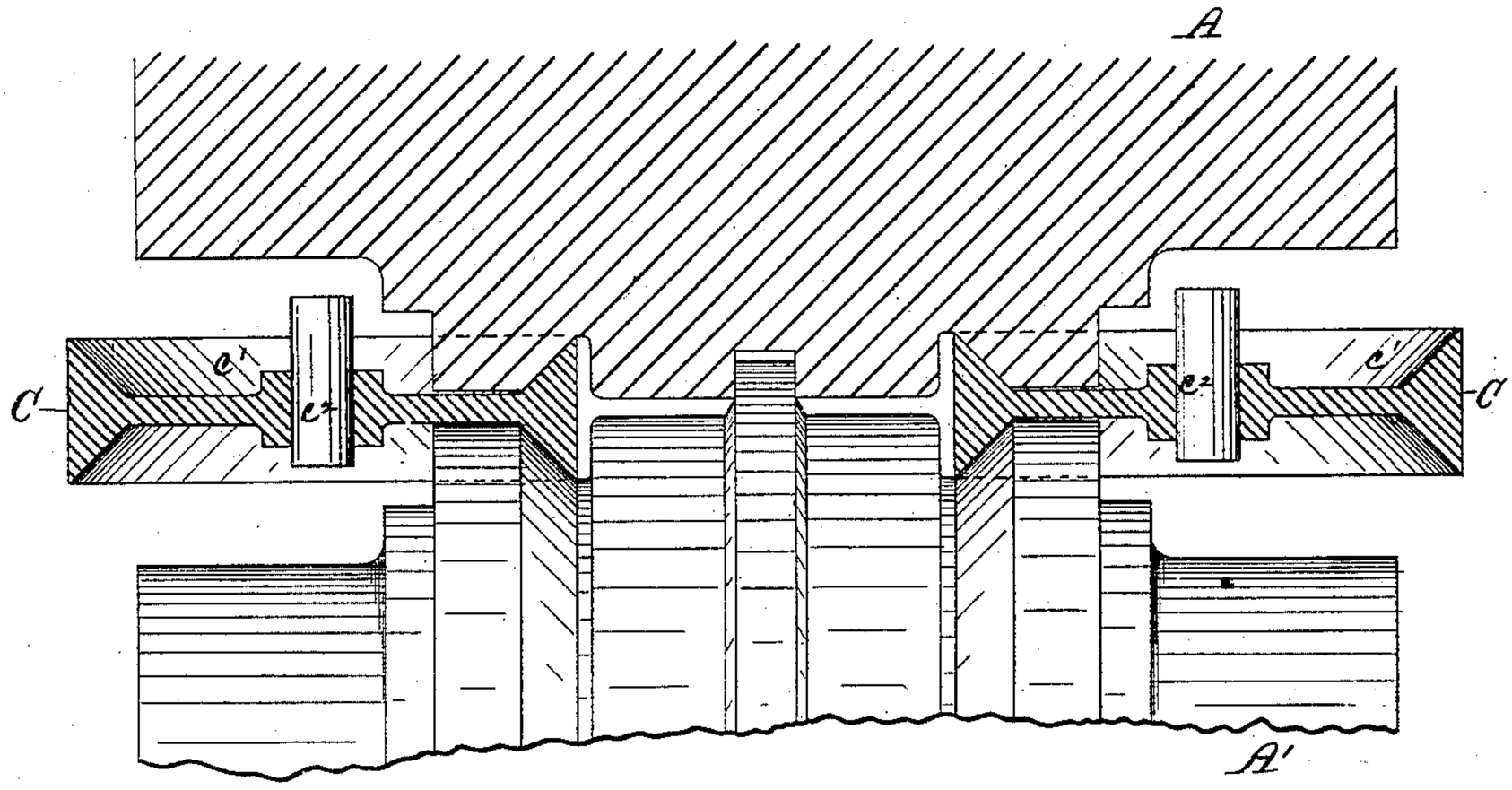
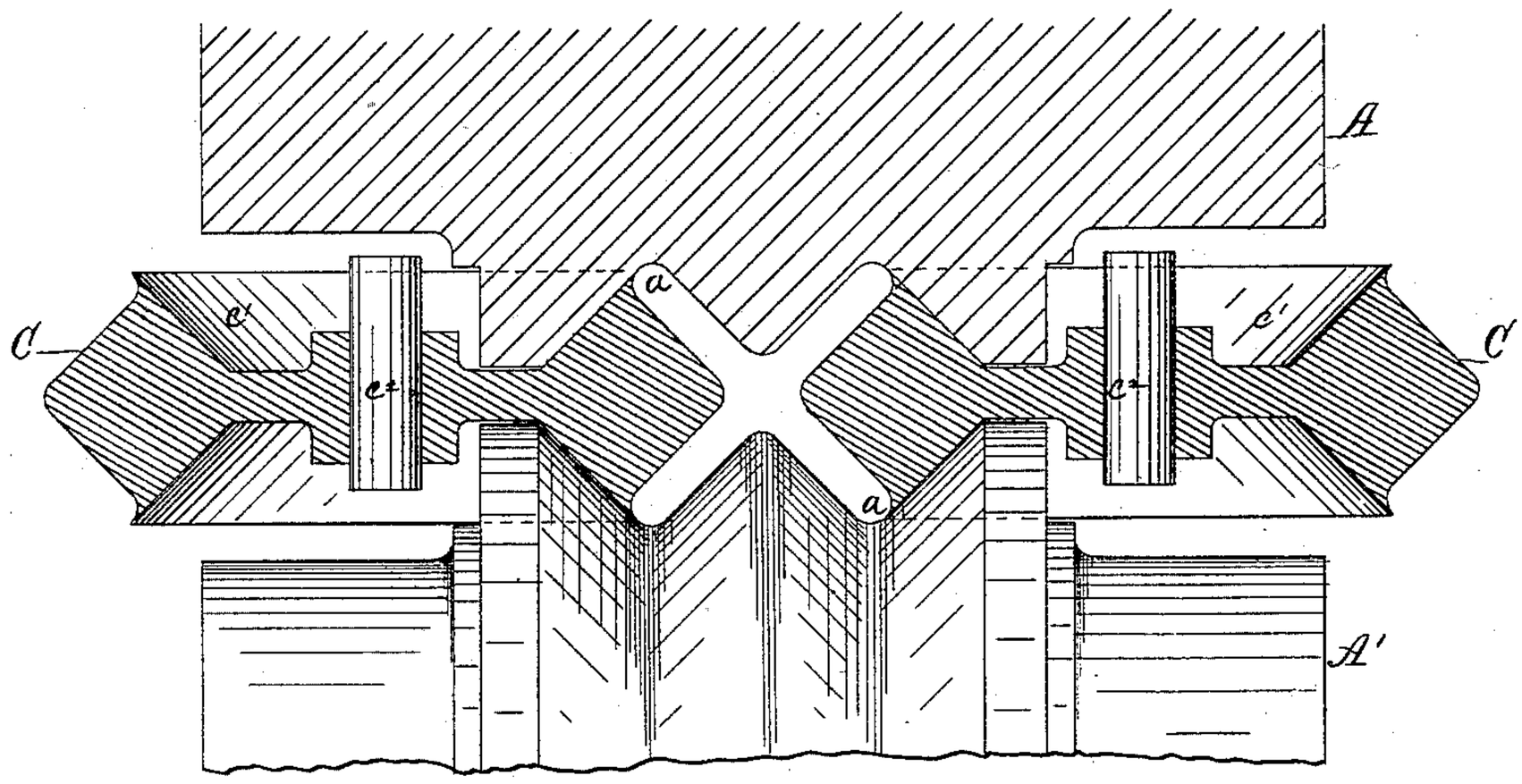


Fig. 6.



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(No Model.) 5 Sheets—Sheet 5.

J. S. SEAMAN.

MACHINE FOR ROLLING BILLETS.

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Fig. 7.

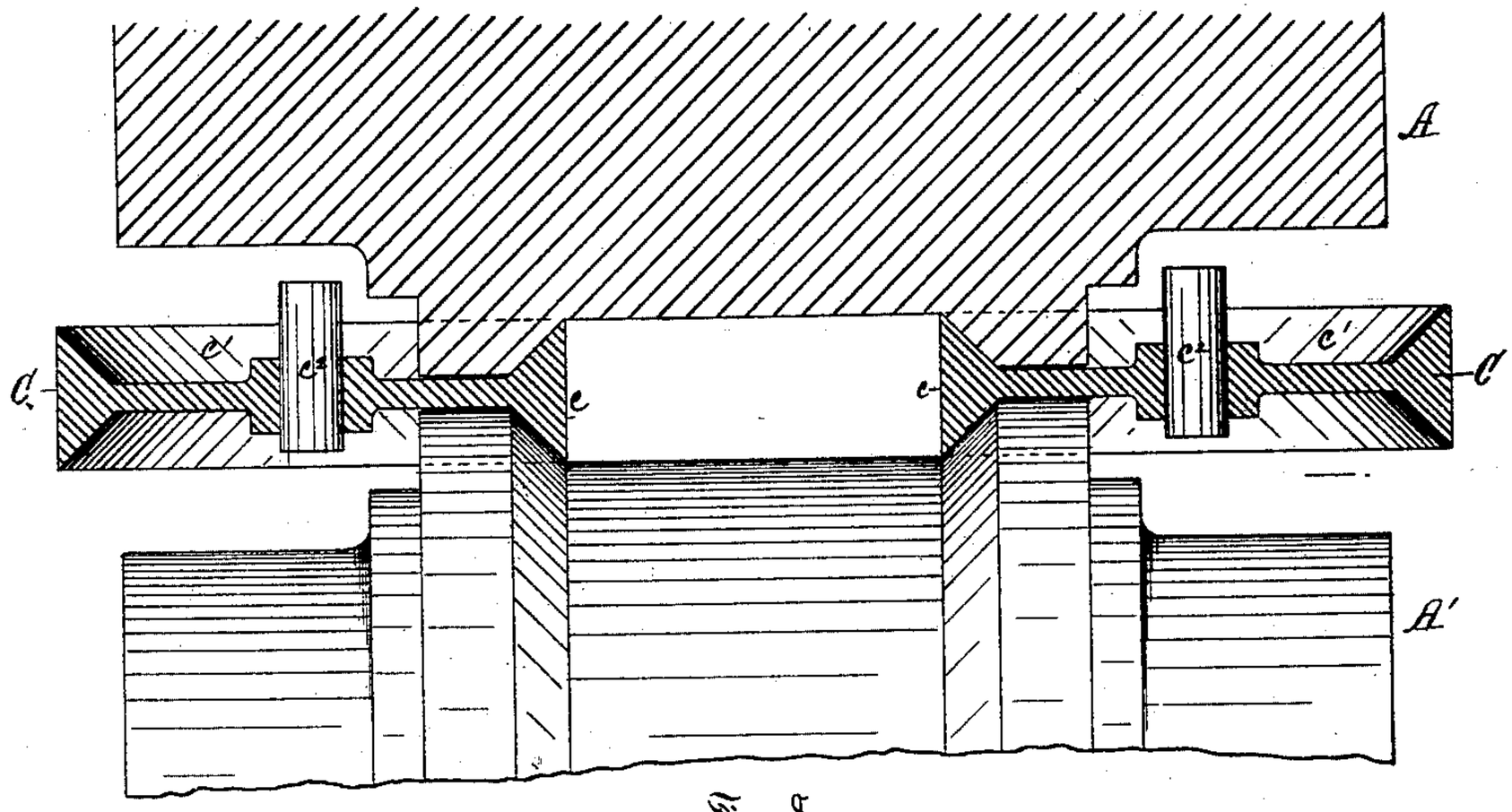


Fig. 8.

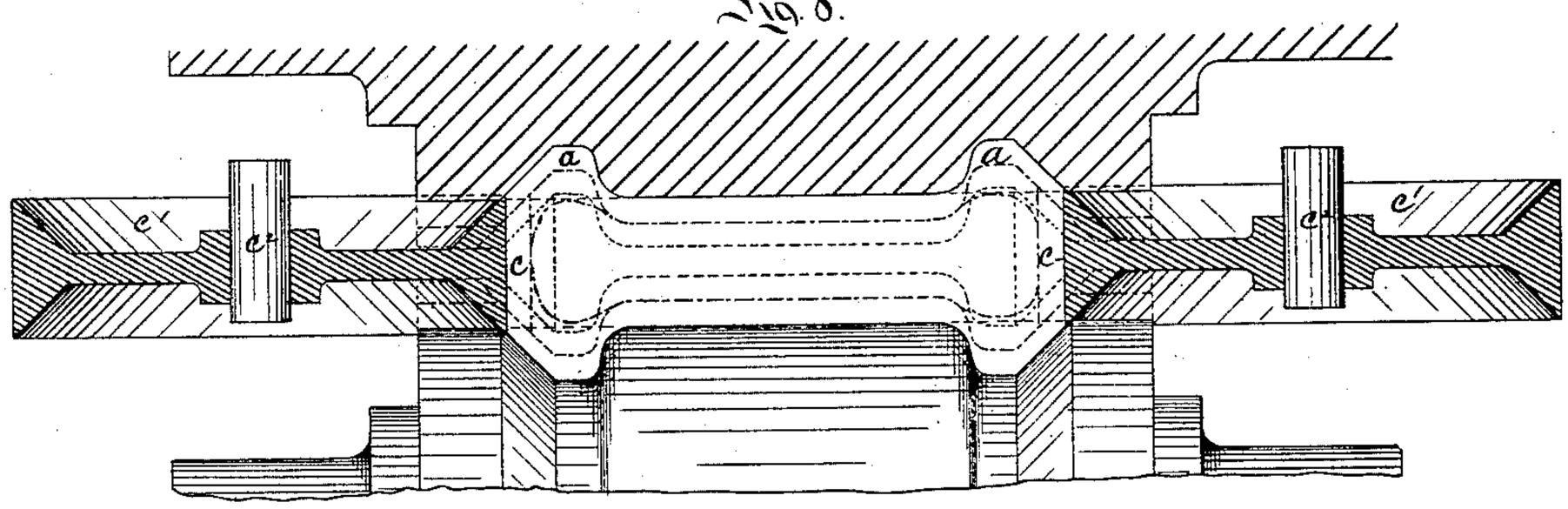
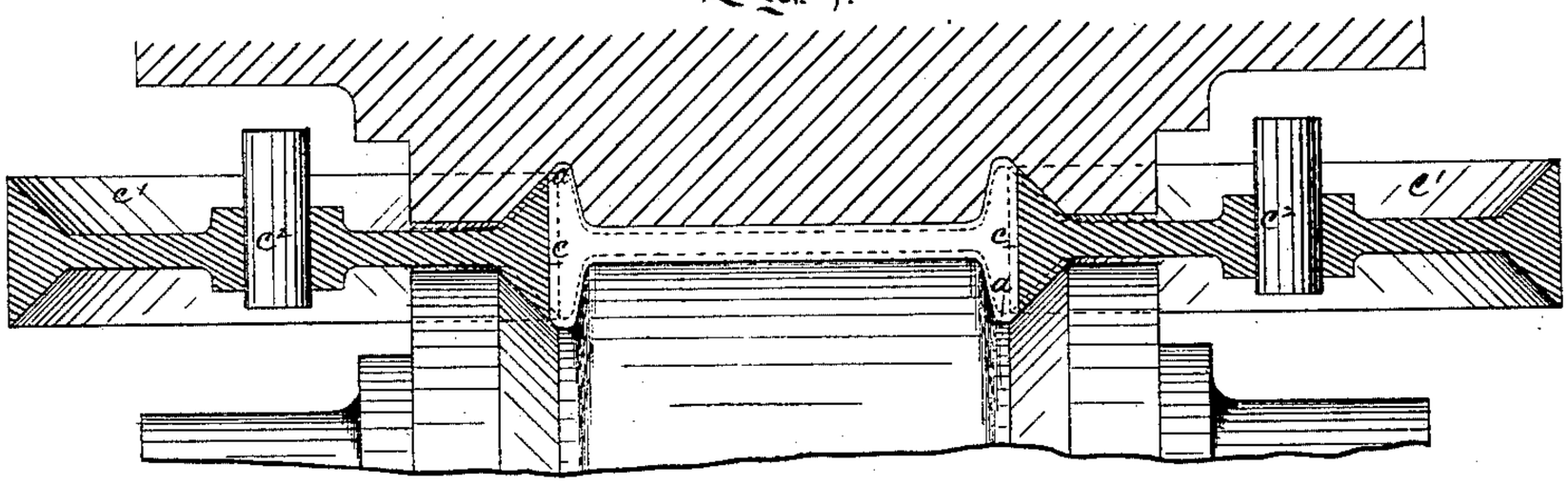


Fig. 9.



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UNITED STATES PATENT OFFICE.

JOSEPH S. SEAMAN, OF PITTSBURG, PENNSYLVANIA.

MACHINE FOR ROLLING BILLETS.

SPECIFICATION forming part of Letters Patent No. 318,513, dated May 26, 1885.

Application filed October 1, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH S. SEAMAN, a citizen of the United States, residing at Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Machines for Rolling Billets, Blooms, Plates, &c.; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—like letters indicating like parts—

Figure 1, Sheet 1, is a side elevation of my mill, certain parts being shown in section. Fig. 2, Sheet 2, is an end elevation, the vertical roll and housing being broken away or shown partly in section. Fig. 3, Sheet 3, is a horizontal sectional view of one of the housings, the vertical roll being broken away to show its under bearing and carrier-block. Fig. 4, Sheet 3, is a perspective view, to an enlarged scale, of one of the vertical rolls. Fig. 5, Sheet 4, shows the form of rolls used in rolling T-irons. Fig. 6, Sheet 4, shows the form of the rolls used in rolling double-angle or star-shaped iron. Fig. 7, Sheet 5, shows the form of rolls used in rolling armor-plate. Fig. 8 shows the form of rolls used in breaking down a bloom, slab, bar, or plate, the shape given to said bloom, slab, &c., by successive passes being indicated by broken lines. Fig. 9 shows the form of finishing-rolls, and the shape assumed by the bloom, slab, &c., after successive passes being indicated by broken lines.

Generally in rolling billets, blooms, slabs, &c., in universal mills the horizontal and vertical rolls, being arranged in different vertical planes, although near together, act in succession on the bloom or billet which is being passed through them—that is to say, the bloom passes forward from the bite of one pair of rolls, and is then caught by the next pair. This method of rolling is objectionable, for the reason that while the vertical rolls are performing their function the central part or web of the bloom or billet is unsupported as against their lateral pressure, and the vertical rolls are more apt to bend or upset the metal of the web than to spread and properly shape the flanges of bloom. It has also been necessary heretofore, in rolling I-beams, T-beams, and other like irons and steels for structural purposes, to build up a pile, when iron is used, of approximately the shape of the article to be made, in order to avoid the great strain to which the iron is subjected in breaking down an ordinary pile to the proper shape for final rolling.

To obviate these and other defects in the method now in use, I so construct the machinery that the horizontal and vertical rolls will act simultaneously on the blooms, bars, billets, &c., and so that an ordinary square or rectangular pile can be broken down to shape without any danger of straining the metal and without the frequent reheating now necessary; and to this end my invention consists in the novel construction and combination of rolls for rolling billets, blooms, &c., substantially as hereinafter described and claimed.

As will be hereinafter explained, my present invention is capable of useful operation in the rolling of various forms of structural irons and steels; but I will first describe it as adapted and organized for the rolling of I-beams.

A A′ are two horizontal rolls, mounted in suitable housings, B B, the upper roll, A, being adjustable to and from the lower roll in any suitable way. The upper roll is held up against the usual adjusting-screw, *b*, by means of rods *b′*, working in slots in the housings B B. The upper ends of these rods are provided with lugs or projections b^2, which fit under the under journal or carrier-block, a^4, of the upper roll. The lower ends of these rods *b′* are stepped in a cross-bar, *d*, of counterweighted levers D.

The rolls A A′ are provided with grooves *a*, such as are used in mills for rolling I-beams; but, in place of making the outside walls of these grooves vertical, they are beveled off, forming inclined or beveled faces a^2.

In order to provide for an edgewise action on the bloom, billet, or slab while passing between the horizontal rolls A A′, and at the same time to secure said action in the vertical plane of the bite of the horizontal rolls, I introduce between the outer ends of the horizontal rolls a pair of vertical rolls, C, so mounted on vertical axes as to bring the rings of the vertical

rolls within the grooves *a* of the horizontal rolls. The upper bearings, c^3, of the axes c^2 of the vertical rolls are mounted in undercut or dovetailed grooves in the under sides of the journals or carrier-blocks a^4, and the under bearings, c^4, of the axes c^2 of the vertical rolls are mounted in slots in the carrier-blocks a^5. The vertical face *c* of the rolls C takes the place of the outer vertical walls of the grooves of the old rolls. The vertical rolls C are provided with dish-shaped or concave ends, the outer walls or faces of the concave or recessed portion being beveled or inclined, as shown at *c'*, each of which matches with or engages the corresponding beveled faces, a^2, of the horizontal rolls, and preferably should have exactly or approximately the same angle of inclination as the bevel faces a^2, each having an inclination of about forty-five degrees (more or less) to the roll-axes. The vertical rolls are rotated by the frictional contact of these beveled faces a^2 and *c'* on the rotation of the horizontal rolls, which is communicated in the usual way. These beveled faces further act as wedges to adjust the horizontal position of the vertical rolls by the vertical adjustment of the upper horizontal roll, and after having adjusted the vertical rolls the beveled faces a^2 hold said rolls firmly in their adjusted positions.

In rolling billets, &c., the lower horizontal roll not being vertically movable, the upper horizontal roll is raised some distance from the lower roll, so as to receive the bloom, and is then gradually forced down toward the lower horizontal roll, and during this vertical movement of the horizontal roll the vertical rolls should be midway between the horizontal rolls, and the beveled faces a^2 and *c'* should be in contact. Therefore the vertical rolls should have not only a vertical, but also a horizontal adjustment, and the vertical movement of the vertical rolls should be only half the vertical movement of the upper horizontal roll. To this end the bearings c^3 and c^4 of the vertical axes c^2 of each vertical roll C are so mounted, as above stated, in the carrier-blocks a^4 and a^5 as to be carried by said carriers, and also capable of horizontal movement on them.

Each of the carrier-blocks a^5 is guided in slots in the standards B B, and is supported and raised by rods *f f*, provided with lugs or projections *f'*, fitting under the carrier-block. These rods *f* are guided in slots in the housing, and rest at their lower ends on friction-rollers *g*, attached to the levers *g'* midway of their length. These levers *g'* are pivoted at *p* to the housings B, and are attached to the cross-bar *d* by a pin passing through a slot in the end of the cross-bar. It will now be seen that, as the rods *b'* are moved directly by the bar *d*, and as the rods *f* are moved by the friction-rollers *g*, located in the middle of the levers *g'*, the vertical rolls C will be moved vertically up or down only half as far as the horizontal roll A, and hence will always be an equal distance from or sustain the same relative position to the rolls A A'.

To obtain the horizontal movements of the vertical rolls C, it is important to keep the beveled faces *c'* of each in constant contact with the corresponding beveled faces, a^2, of the horizontal rolls during the vertical adjustment of the horizontal roll A and the vertical rolls C. For this purpose arms c^6 and c^7 are attached to the bearings c^3 and c^4, and through eyes in the ends of these arms are passed rods *h h'*, which also pass through inclined slots *e e'* in brackets E, secured to the housings on each side of the vertical rolls; and hence as the vertical rolls are moved up and down they must through these connections also move in and out horizontally. As the upper bearing, c^3, is attached to the upper carrier-block, a^4, and consequently moves a farther distance with each upward and downward movement of the rods *b'* than the lower bearing, c^4, the slot *e* has a less inclination from the axis c^2 of the roll C than the slot *e'*, in order that the upper bearing, c^3, shall have the same amount of horizontal movement as the lower bearing, c^4.

In order to provide for the greater vertical movement of the upper bearing, c^3, the shaft c^2 is made to project a little above the vertical roll, in order to prevent the upper bearing from being drawn off the shaft. To accommodate this projection of the shaft, when the upper horizontal roll is screwed down to its lowest point a recess, a^6, is formed in the under surface of the upper carrier-block, a^4. It will be observed that the parts of the mill should, in order to attain the best results, be so adjusted that the beveled faces *c'* of the rolls C will always be in firm contact with the beveled faces a^2 of the rolls A A'.

In the operation of the mill, the rolls A A' and the rolls C C' being drawn apart sufficiently to admit a bloom as the roll A is depressed by the screw *b*, it will force down the carrier-block a^4, and consequently the rods *b'* and cross-bar *d*, and as the cross-bar *d* lowers the outer ends of the levers *g'* will drop, permitting of the descent of the rods *f* and the carrier-blocks a^5, thus allowing the free descent of the vertical rolls, or of their being forced down by the upper carrier-block in its descent, and as the vertical rolls descend they are forced inward horizontally by the rods *h h'* moving down the inclined slots *e e'*, aided somewhat perhaps by the beveled faces a^2 bearing against the beveled faces *c'*.

In place of the devices above described for drawing the vertical rolls outward, so as to keep their beveled faces against the beveled faces of the horizontal rolls, I may use a spring arranged to bear against the inner ends of the bearings c^3 and c^4, and secured at its ends to the carrier-blocks by bolts, as represented by the dotted lines *n*, Fig. 3.

The beveled faces of the horizontal and vertical rolls are shown at an angle of forty-five

degrees, at which angle the sum of the horizontal movements of both vertical rolls is equal to the vertical movement of the horizontal roll—that is to say, if the horizontal roll moves down half an inch each of the vertical rolls will move inwardly a quarter of an inch; but by increasing or lessening the inclination of the beveled faces of the rolls the vertical rolls may be made to move in more or less than the movement of the horizontal roll. When the inclination of the beveled faces is changed, the inclination of the slots *e e'* in the brackets E should be correspondingly changed.

I have described, and shown in Figs. 1, 2, and 3, rolls adapted to form I beams; but it is obvious that other shapes, without departing from the spirit or scope of my invention, may be produced by simply changing the form of surfaces of the several rolls—as, for instance, in Fig. 5 are shown rolls adapted to form a double set of T-shaped irons, either of which used separately would embody my invention; in Fig. 6 are shown rolls adapted to form double-angle or star irons, and in Fig. 7 are shown rolls adapted to roll armor-plates. In the construction shown in Fig. 5 one of the horizontal rolls is shown as having a peripheral groove or recess about midway of its length, into which fits a corresponding fillet, *m*, on the other horizontal roll, thus giving to each horizontal roll two rolling or operative faces, *k*, each provided with a groove, *a*, adapted for the reception of the periphery of the vertical roll. The rolls thus constructed are adapted for rolling T-irons, and both rolling or operative faces *k* may be used simultaneously, thereby producing two T-irons at the same operation; or only one of said operating or rolling faces *k* may be used. In these figures the letters of reference indicate the same parts as in Figs. 1 to 4, and from the foregoing and following description and an inspection of the drawings the skilled workman will be able to use the invention in the making of any of the forms of product illustrated or other like forms.

In the practical use of my invention I preferably embody the features above shown and described in a pair of breaking-down rolls, but with a somewhat modified contour, as illustrated in Fig. 8. The upper roll being sufficiently raised and the vertical rolls correspondingly moved outward, the bloom or pile is passed through, and gradually and by successive passes it is, as the rolls are closed together, brought to and through the successive forms shown by dotted lines, being not only elongated at each pass, and made thinner along its middle portion, but also upset at its edges by the vertical rolls into the grooves *a*, and this operation goes on regularly and progressively until the proper shape is attained. It will be observed that the bloom is not subjected to any stretching or straining in order to force the metal into the grooves, but that it is upset by the vertical rolls in a manner similar to the upsetting of a bolt to form the head, and that during this upsetting the horizontal rolls firmly hold the central or web portion, thus preventing the bending or upsetting of that portion of the bloom or billet. The shapes which the bloom or billet assumes during the successive passes through these breaking-down rolls are clearly shown by the dotted lines in Fig. 8. After the bloom or billet has been reduced to shape by the breaking-down rolls, it is then taken to the finishing-rolls—say such as are illustrated in Fig. 9—and there reduced to its final shape. As the bloom as it comes from the breaking-down rolls will fill or approximately fill the space between the finishing-rolls, the flanges previously formed on the edges of the billet also filling or nearly filling the grooves *a*, the beveled faces a^2 on the horizontal rolls now perform the additional function of the fillets which heretofore have been made in one corner of the grooves of the ordinary rolls. These beveled faces force the metal over against the opposite walls of the groove of the horizontal rolls, and prevent the metal from being squeezed in between the beveled faces of the two rolls, which would form a fin. This fillet or beveled face is gradually shortened as the upper horizontal roll is forced down, and by forcing down the horizontal roll until the edges of the vertical rolls have reached the bottom of the grooves *a* the fillet function is caused to disappear entirely and a square corner is produced on the finished product, and also in the breaking-down or other rolls of the construction described the beveled sides a^2 will perform the fillet function to the extent that the metal may be brought or come into contact with such sides near their line of junction with the vertical rolls; and it will be observed that the beveled face a^2 extends from the working-face of one roll to and over the end of the other roll, thereby forming a bridge or working-face between the rolls; and, further, these beveled faces a^2 in lapping on the inclined faces c' of the vertical rolls serve, in addition to their other functions, to hold the vertical rolls with practical rigidity to their work.

I have hitherto shown and described only the upper roll as adjustable; but I consider it within my invention to make both rolls adjustable to and from each other, in which case the mechanism for supporting and adjusting the vertical rolls should be so modified as to cause these vertical rolls to retain or take the same positions relative to the horizontal rolls as they now do.

The terms "horizontal" and "vertical" as applied to the two sets of rolls are used relatively and not absolutely.

The operations involved in the use of such a mill as above described have the following among other characteristic features: First, one pair of rolls takes a working-bite on the plate, bloom, bar, or slab over less than its greatest width, except at the final shaping and

finishing pass or passes, and said plate has one or both edges unconfined and free to be upset and thickened by expansion above and below the planes of such bite; second, such laterally-projecting edge or edges are upset or worked in and thickened by expansion above and below the planes of bite by a roll or rolls the axis or axes of which are at right angles to the axes of the other rolls; third, the work on the plate, bar, bloom, or slab is done simultaneously on three or more sides in the same vertical plane, and, fourth, such rolls coact at different adjustments so as progressively by successive passes, and simultaneously at each pass, to elongate and narrow the bar and broaden or expand its edge or edges in such manner that no one of said last three operations interferes with either of the others; also, the roll structure described has the further and, as I now believe, the novel feature that the vertical length of the periphery of each vertical roll is by the bringing together of the horizontal rolls after the first pass greater than the least distance between said horizontal rolls.

The same apparatus without further invention may be applied to three or four high rolls.

And it is further characteristic of the operation described that the breaking-down rolls, Fig. 8, cause the flange at each edge of the beam to be made wider than is desired in the finished article, and also the beam itself to be made wider. Then when the beam is transferred to the finishing-rolls, Fig. 9, the walls a^2 and the bottom portions of the groove a act on the edges of each flange so as to upset the same or narrow them in width; also, the finishing-rolls not only thus narrow the flanges by an upsetting action, but also while elongating the beam narrow it transversely by a lateral upsetting action, as represented by the dotted lines of Fig. 9, which represent the planes of finish. The work of upsetting is thus principally effected in the finishing-rolls.

As I have described my invention some portions of it may be embodied in or carried out by the use of three rolls, and other parts only by the use of four or more rolls, and hence I apply to this element of construction the term "multiple rolls" as a term descriptive of an element common to both.

From the foregoing description it will be seen that several independent or separate functions are performed or elements of utility are attained by virtue of the presence of the beveled sides a^2 of the grooves a and the beveled ends c' of the rolls C, and in the features of construction and combination hereinafter claimed I expressly include the same, whether organized for the accomplishment of one or more of the features of novel operation thereunto belonging. For example, the driving of one pair of rolls by frictional contact with the other, as described, is not essential in all cases to the performance of that function which excludes the formation of a fin, since contact with the billet itself will in many cases effect the driving of the vertical rolls; also, that feature of construction by which each beveled side a^2 forms a bridge from the groove a across to the working-face of the contiguous vertical roll is a feature not necessarily dependent on any matter of roll-adjustability. And it may be further noted as a peculiarity of the bevels or inclines a^2 that while they may vary at pleasure as regards their length and somewhat as regards their inclination, they should be arranged at one or both ends of the working peripheries of their respective rolls, and so bound such peripheries or limit their extent, and also should incline inwardly or toward the opposite roll; and in speaking of all these rolls working, as they do, in the same or in a common plane of bite, I do not use that phrase in its mathematically-exact sense, since the lines of bite of one pair of rolls may be adjusted a little forward or back—say the fractional part of an inch, more or less—in their relationship to the lines of bite of the other pair of rolls; hence I use this term in the sense of a practically common plane of bite, or of a construction in which all the lines of bite shall be in or approximately in a common plane of bite. And it will also be understood that a groove, as a groove, is not essential in all cases to the existence of the inclines or bevels a^2, and hence that the metal inside the bases of the inclines a^2 may be cut away entirely, as in Fig. 7, or to any desired greater or less extent, accordingly as it may be desired to vary the shapes formed by the working-faces of the upper and lower rolls inside of such bases.

For most if not all purposes of inward adjustment of the vertical rolls the wedge-like action of the inclines a^2 c' on each other will suffice, and when the machine is so organized a spring, substantially as shown and described with reference to Fig. 3, (including within that term its well-known mechanical equivalent, a weight,) is, as I now consider it, the best by which to effect the outer adjustment of such rolls, and then the bracket E, with its inclined slots, &c., ceases to be essential, though it will do the work assigned to it when used; but whichever is used as a means of giving to the vertical rolls an inward movement, they are both alike in this, that the downward movement of the upper horizontal roll, operating by the inclines of the roll-bevels or by the inclines of the slots, effects the desired result, and hence for the purposes of the present case both may, with their mechanical equivalents, be included under the common term of an "inclined guide mechanism;" also, the arrangement of rods and levers by which the vertical rolls are lifted for purposes of outward adjustment may, with their mechanical equivalents, be included in the term "vertical lift mechanism."

What I claim herein as my invention is—

1. A vertical roll or rolls dish-shaped or re-

cessed at the ends thereof, in combination with a pair of horizontal rolls, each having a working-face terminating in an inwardly-sloping bevel or incline at one or both ends thereof, which latter bevels or inclines overlap the bevels or inclines of the recessed ends of the vertical rolls, substantially as set forth.

2. An adjustable vertical roll or rolls dish-shaped or recessed at the ends thereof, in combination with a pair of horizontal rolls, one at least of said rolls being adjustable, and each having a working-face terminating in an inwardly-sloping bevel or incline at one or both ends thereof, which latter bevels or inclines overlap the bevels or inclines of the recessed ends of the vertical rolls, substantially as set forth.

3. In a metal-rolling machine having rolls arranged for simultaneous operation on all sides of the same bar, billet, slab, &c., the combination of the following elements: a vertical roll or rolls having dish-shaped or recessed ends, and a pair of horizontal rolls having at one or both ends of the working-faces an inwardly-sloping bevel or incline arranged to overlap the corresponding bevel or incline of the adjacent vertical roll, substantially as set forth.

4. In a metal-rolling machine having rolls arranged for simultaneous operation on all sides of the same bar, billet, slab, &c., the combination of the following elements: an adjustable vertical roll or rolls having dish-shaped or recessed ends, and a pair of horizontal rolls, one at least of said rolls being adjustable, and each of such rolls having at one or both ends of its working-face an inwardly-sloping bevel or incline arranged to overlap the corresponding bevel or incline of the adjacent vertical roll, substantially as set forth.

5. In a rolling-machine, the combination of the following mechanisms: adjustable recessed vertical roll or rolls having an incline or bevel, c', on each end thereof, and a pair of horizontal rolls, one at least of said rolls being adjustable, and each of such rolls having a cut-away part on its periphery, and provided with an inwardly-sloping bevel or incline, a^2, at one or both ends of such cut-away part, arranged to overlap the corresponding bevel or incline, c', of the adjacent vertical roll, substantially as set forth.

6. The combination of a pair of horizontal rolls having each a length of bite shorter than the greatest width of the bloom or other article to be rolled, and one at least of such rolls being adjustable toward one or from the other, and one or more adjustable vertical rolls dish-shaped or recessed at their ends, and arranged for edgewise bearing and operation against the edge or edges of such bloom or other article as laterally widened by the horizontal rolls, the horizontal rolls being provided with an inwardly-sloping bevel or incline, a^2, at one or both ends of the working-faces of each, the bevels or inclines a^2 being constructed to overlap the corresponding bevels or inclines on the ends of the adjacent vertical roll or rolls for the edgewise spreading of the bloom or other article under the compressing or upsetting action of the vertical roll or rolls, substantially as set forth.

7. The combination of a pair of horizontal rolls having each a length of bite shorter than the greatest width of the bloom or other article to be rolled, one at least of such rolls being adjustable toward and from the other, and one or more vertical rolls dish-shaped at their ends, and arranged for edgewise bearing and operation against the edge or edges of such bloom or other article as laterally widened by the horizontal rolls, and adjustable in or out automatically by or from the horizontal rolls in the adjusting movement imparted to them, said horizontal rolls being provided with an inwardly-sloping bevel or incline, a^2, at one or both ends of the working-faces of each, said inclines or bevels a^2 being constructed to overlap the corresponding bevel or incline on the ends of the vertical roll or rolls, substantially as set forth.

8. A vertical roll, C, having dish-shaped or recessed ends, and having its periphery or working-face operative within the grooves of a pair of horizontal rolls, and in combination with such rolls, substantially as set forth.

9. In a metal-rolling machine having rolls arranged for simultaneous operation on all sides of the same bloom or other article to be rolled, and in combination with the horizontal rolls thereof, one at least of such rolls being adjustable, a vertical roll or rolls adjustable to and from the path of the article to be rolled, and actuated by the horizontal rolls in the adjusting movement imparted to them, substantially as set forth.

10. In a mill for rolling structural irons and steels, the combination of one or more vertical rolls having dish-shaped or recessed ends, and a pair of horizontal rolls provided with bevels or inclines a^2, each of which overlaps the corresponding incline, c', of the adjacent vertical roll, such rolls being so arranged that the vertical rolls are driven by frictional contact of such overlapping beveled faces, substantially as set forth.

11. In a mill for rolling billets, slabs, and other structural irons and steels, the combination of a pair of horizontal rolls mounted in suitable housings, one at least of said rolls being adjustable, a pair of vertical rolls mounted in the same housings, and an inclined guide mechanism for adjusting the vertical rolls horizontally, actuated by the horizontal rolls in the adjusting movement imparted to them, substantially as set forth.

12. In a mill for rolling billets, slabs, and other structural irons and steels, the combination of a pair of horizontal rolls, one at least of said rolls being adjustable, a pair of vertical rolls, and a vertical lift mechanism for imparting a vertical movement to the vertical

rolls, actuated by the horizontal rolls in the adjusting movement imparted to them, substantially as set forth.

13. In a mill for rolling structural irons and steels, the combination of a pair of horizontal rolls, one at least of said rolls being adjustable, a pair of adjustable vertical rolls, the inclined guide mechanism, and the vertical lifting mechanism for adjusting the vertical rolls, the moving elements of these two mechanisms being actuated by or from the horizontal rolls in the adjusting movement imparted to them, substantially as set forth.

14. In a mill for rolling structural irons and steels, the combination of an adjustable vertical roll or rolls dish-shaped or recessed at their ends, a pair of horizontal rolls, one at least of said rolls being adjustable, and each provided with a bevel face or incline at one or both ends of its working-face, said bevel or incline overlapping the corresponding bevel on the adjacent vertical roll, the inclined guide mechanism, and the vertical lift mechanism for holding said beveled faces in contact at different points of roll adjustment, substantially as set forth.

15. In a mill for rolling billets, slabs, beams, and other structural shapes, the combination of a pair of horizontal rolls, rods b', provided with lugs supporting the carriers a^4 of the upper roll, with vertical rolls C, carriers a^5, rods f, provided with lugs f', levers g, having rollers g', cross-bars d, and weighted levers D, substantially as set forth.

16. A pair of horizontal rolls, one at least being adjustable, and each having a working-face terminating in an inwardly-sloping bevel or incline at one or both ends thereof, and one or more vertical rolls having dish-shaped or recessed ends, said rolls being relatively arranged so that the bevels or inclines of the horizontal rolls shall overlap the corresponding inclines of the vertical rolls, and operate by a hook-like action on each other for purposes of adjustment, in combination with a spring, n, arranged to operate against such hook-like action of the inclines, substantially as set forth.

In testimony whereof I have hereunto set my hand.

JOSEPH S. SEAMAN.

Witnesses:

DARWIN S. WOLCOTT,

J. SNOWDEN BELL.