2 Sheets—Sheet 1.

A. KLOMAN.

METAL ROLLING.

No. 188,741. Patented March 27, 1877.

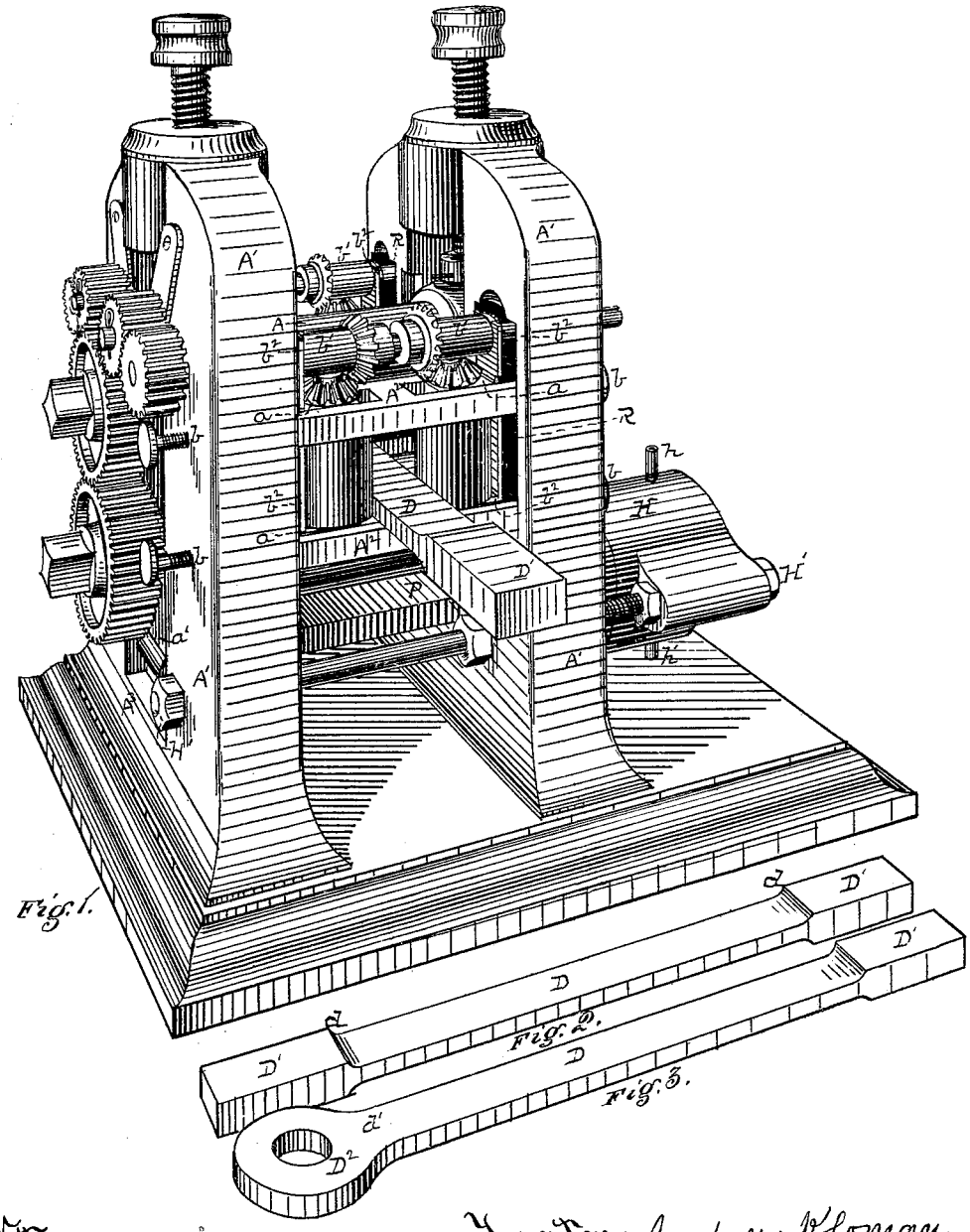

Fig. 1.

Fig. 2.

Fig. 3.

Witnesses
C. L. Parker

Inventor Andrew Kloman
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2 Sheets—Sheet 2.

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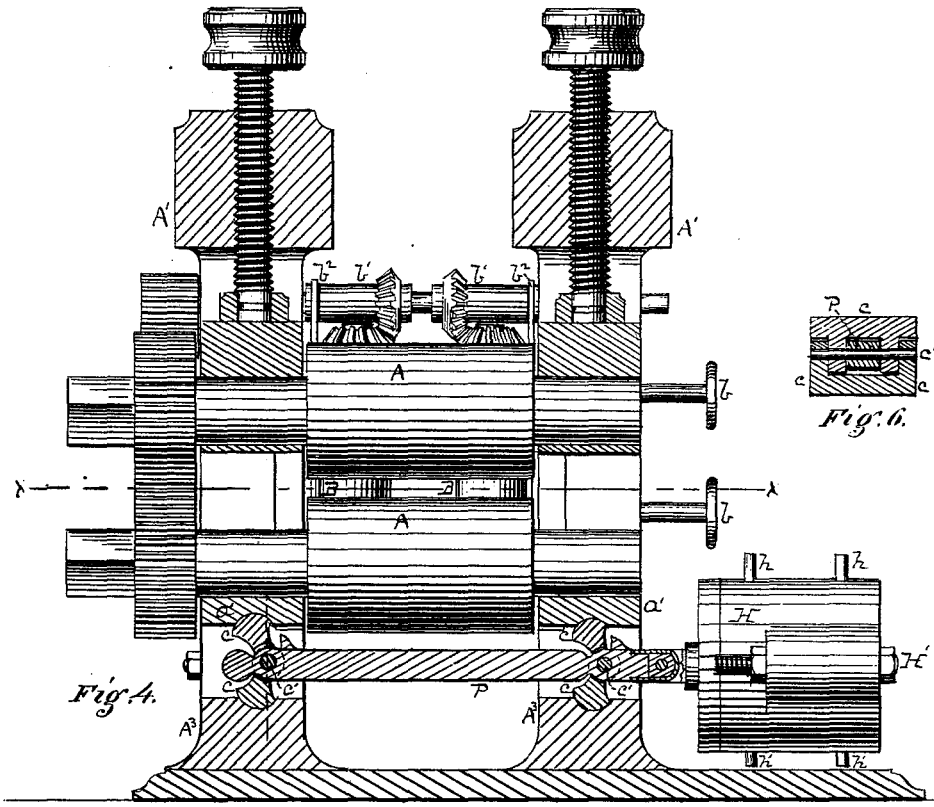

Fig. 4.

Fig. 6.

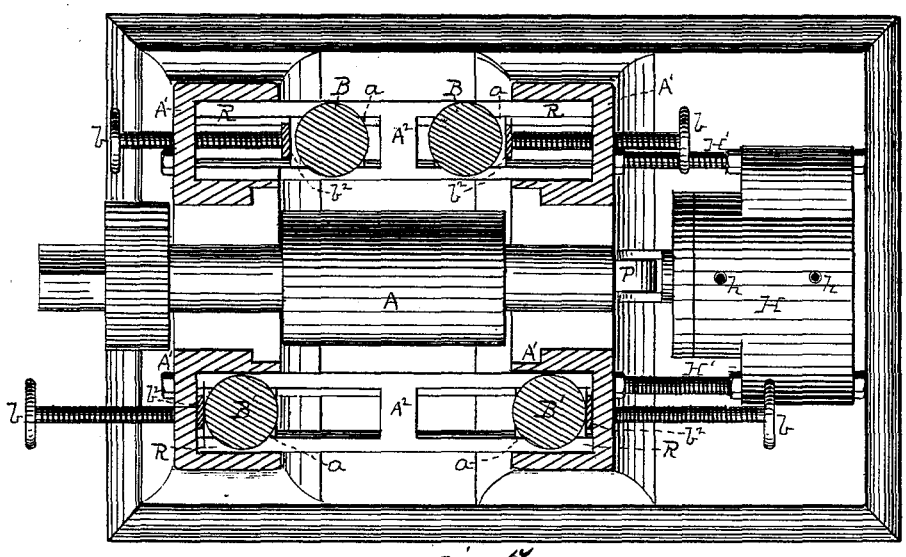

Fig. 5.

Witnesses
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By Attorney George H. Christy

UNITED STATES PATENT OFFICE

ANDREW KLOMAN, OF PITTSBURG, PENNSYLVANIA.

IMPROVEMENT IN METAL-ROLLING.

Specification forming part of Letters Patent No. **188,741**, dated March 27, 1877; application filed February 5, 1877.

To all whom it may concern:

Be it known that I, ANDREW KLOMAN, of Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Metal Rolls and Metal-Rolling; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawing, in two sheets, making a part of this specification, in which—like letters indicating like parts—

Figure 1, Sheet 1, is a perspective view of my improved metal-rolling machine. Fig. 2 shows the product thereof. Fig. 3 illustrates the manner of finishing such product for use. Fig. 4, Sheet 2, is a longitudinal vertical sectional view through the plane of the axes of the horizontal rolls, but showing the rolls and hydraulic cylinder in elevation. Fig. 5 is a horizontal section through or along the line *x x* of Fig. 4, and Fig. 6 is a transverse vertical section through one of the toggle-joints by means of which the lower roll is raised and lowered.

In the manufacture of bridge-links and other articles of like kind, in which an enlarged body of material is desired in some one part, so as to provide for a reduction in such part by punching, thread-cutting, or otherwise, for purposes of effecting a connection with some other part of a structure, various practical difficulties have been encountered in making such enlargement. Plating has been tried; but, considering the plated part as a head, the bar or plate is weakened at the base of the head by the deflection or break of its fiber in welding on the side plate or plates. Upsetting has been largely resorted to; but, on very large or heavy work, it has been found that the distortion of the fiber caused by the upsetting operation sometimes so weakens the material or lessens its tensile strength that its use is objectionable.

To meet the requirements of this class of work I have invented what I believe to be an improvement in the art of rolling metals, as well as an improvement in apparatus therefor.

The machinery shown in the drawing is of the pattern or class generally known as a "universal mill," having two horizontal rolls, A A, and two pairs of vertical rolls, B B B′ B′, all mounted in suitable housings A^1 A^2, and driven by the usual or any desired line of gearing, as illustrated more particularly in Fig. 1. The cross-bars A^2 of the housings are slotted, as shown, so that the bearings *a* of the vertical rolls may play therein by tongues and grooves, or equivalent means, and adjusting-screws *b*, connected with these bearings, are employed to set the vertical rolls toward or from each other. These vertical rolls have the usual bevel-pinions, as shown, operated by the usual counter-pinions on the driving-shafts. These counter-pinions are attached directly to adjustable movable sleeves b^1, which have a groove-and-feather connection with their shafts, and to which the same longitudinal motion is given as to the vertical rolls by means of the fork and strap b^2, which is connected with the moving bearings *a* below. The other parts of the mill, except as hereinafter described, are such as are already known in the art.

One part of my invention relates to the manufacture of link-bar blanks, such as are shown in Fig. 2, by rolling them with a body part, D, of the desired size, and ends D^1 of an enlarged size, such that, after subsequently forging down by rolls, hammer, or otherwise, such enlarged ends, as at D^2, Fig. 3, and after punching or forging an eye, as there shown, the tensile strength of the parts so operated on will not fall materially, if at all, below that of the body D. To this end I bring the bar, by any ordinary rolling or forging operation, to the size, or about the size, in cross-section of the ends D^1. I then stop or arrest the further reduction of the ends, but continue the rolling down and reduction of the body D intermediate between the points *d d* by passing the bar back and forth between the horizontal rolls A A, (employing the vertical rolls for edging purposes,) but stopping the movement of the bar whenever each point *d* comes to the horizontal rolls; and, by reversing the motion of the rolls, I then start the bar on its reverse pass. Simultaneously with each reverse motion I lessen the distance between the horizontal rolls, so as, by each successive pass, to draw and reduce the body part D without lessening the size or affecting the disposal of

the metal in the ends D^1. This work goes on until the bar has been brought to the form of blank desired, having the substantial characteristics shown in Fig. 2.

I will now explain the mechanism by which this operation is carried on. For reversing the motion of the rolls, any devices suitable for the purpose may be employed, such as a reversing clutch and gear; but, preferably, the engine which drives the machinery should be reversed by the use of the ordinary link. The action should be quick, complete, and exact, and for this purpose I believe a pneumatic or hydraulic piston, with a piston-stem connection to the link, to be the best. For raising and lowering one of the horizontal rolls, (preferably the lower one,) I employ a hydraulic cylinder, H, fitted with the usual plunger and with pipe-connections *h h h' h'*, for admitting and discharging hydraulic pressure to and from opposite sides of the plunger, in the usual way. The valve or cocks and the connections with an accumulator I do not deem it necessary to show, as the construction of such devices will come within the knowledge of those skilled in the art. This hydraulic apparatus is securely fastened to the housings A^1 by bolts H', or otherwise properly secured in place. The lower horizontal roll A rests in movable bearings *a'*, and between these bearings and the bottom part or foundation A^3 of the housings, and at each end of the roll, is a toggle-joint, *c c*, the opposite halves of which are, by a pintle, *c'*, hinged to each other, and both to a follower, P, which latter is connected with the plunger of the hydraulic press H. As a hydraulic plunger and toggle-joint give the capacity of great quickness and accuracy of motion, immense power, and a short stroke, I believe them to be the best for the purpose, and I believe it best to apply them to shifting the position of the lower roll; but by an inverted or reverse action the same devices may be applied to shifting, in like manner, the position of the upper roll; and in so far as relates to the operation of reducing the bar to the blank shown in Fig. 2, other suitable known means for raising or lowering one roll at intervals or at the pleasure of the operator, may be substituted for those described, as the mechanical equivalent thereof.

It will now be understood that the rolls are to be reversed, and the movable roll shifted slightly toward the other whenever either point *d* of the bar comes to the horizontal rolls, so as thereby to give the bar a reverse pass, and on such reverse pass to effect a still further reduction of the body D; and it is a characteristic feature of the operation described that the reduction described is effected without the bar at any time leaving the rolls. The horizontal rolls, from the beginning to the end of the operation, never lose their bite on the bar. As soon as the body part D is brought to the proper reduced form and size the movable roll is shifted away from the other, the blank thus made is taken out, and each end is then worked down and punched, as represented at D^2 in Fig 3, which gives a bridge-link having the desired tensile strength across the eye, and also at the point *d'*, where it merges into the body D.

The same mode of operation, by substantially the same devices, may be applied to the manufacture of tie-rods, the ends of which are to be punched or slotted for the insertion of a key, or threaded for the screwing on of a nut. The reduced body and enlarged end or ends are made in the same way as above described, grooved rolls being substituted for plain faced rolls, though the latter may also be grooved, if so desired.

Another part of my improvement relates to the boxing out of the upright parts of the housings. There is a growing demand for steel for bridge and other architectural purposes, and the rolling of heavy steel bridge-links, girder-beams, plates, and bars involves a heavy strain on the machinery.

In the universal mill heretofore the horizontal rolls were made as long as the greatest width of plate or bar to be passed through, plus the diameters of the two vertical rolls. The horizontal rolls are then too long to stand heavy strains with safety. By boxing out the housings, or making them open on their inner adjacent faces, next to the vertical rolls, I provide for setting the vertical rolls back, and shortening the horizontal rolls by nearly or quite twice the diameter of each vertical roll, so that the machinery is more compact, and the horizontal rolls will withstand a much greater strain. This boxing out of the housings is represented at R, and the size of the openings or boxes so made is such as to permit the vertical rolls to be shifted back within such boxes, so that a greater length of roll-surface in the horizontal rolls can be utilized in practical rolling than if the vertical rolls stood within the inner faces of the housings, as heretofore. Or, to state the same thing in another way, the horizontal rolls may be shortened at each end by an amount equal, or nearly equal, to twice the diameter of each vertical roll, so that the working-faces of the vertical rolls along their lines of bite can be brought into line with, or a little inside of, the ends of the horizontal rolls, whereby the entire length of the working-faces of the latter may be utilized in rolling the material to be operated on. The form of the openings or boxes R is not material, provided only the vertical rolls, with their driving-gear, be capable of being shifted, wholly or nearly so, back of the inner adjacent faces of the housings, and thereby utilize the entire, or almost the entire, length of available working-surface in the horizontal rolls, or permit of their being to the same extent shortened; and to this end the vertical parts of the housings may be made crank-shaped, or with a double elbow, turning outward—one at or above, and one at or below, the ends of the vertical rolls. The

blanks herein described, and shown in Fig. 2, constitute articles of manufacture and sale. As the business is now carried on in some portions of the country, they are made by the iron-roller and sold to the bridge-builder.

I claim herein as my invention—

1. The method of rolling malleable metals to varying sizes in cross-section by reversing the motion of the rolls while the bar is still engaged by them, or is still within their bite, and simultaneously forcing the biting rolls into closer proximity, substantially in the manner set forth.

2. The rolled bridge-link blank D D^1, substantially as described with reference to Fig. 2.

3. In combination with a pair of metal rolls, A A, a hydraulic cylinder and plunger operating a toggle-joint, whereby one roll is caused to move to or from the other, substantially as set forth.

4. The housings, with their recesses R constructed to receive the whole or the greater part of a vertical roll and its driving-gear, in combination with such roll and driving-gear, and with means of adjustment for adjusting such roll and gear into or entirely out of the recess of the housings, substantially as set forth.

In testimony whereof I have hereunto set my hand.

ANDREW KLOMAN.

Witnesses:

CHAS. H. KLOMAN,

WILLIAM C. BARR.