

(No Model.)

A. C. KLOMAN.  
ROLLING STEEL BEAMS.

No. 244,811.

Patented July 26, 1881.

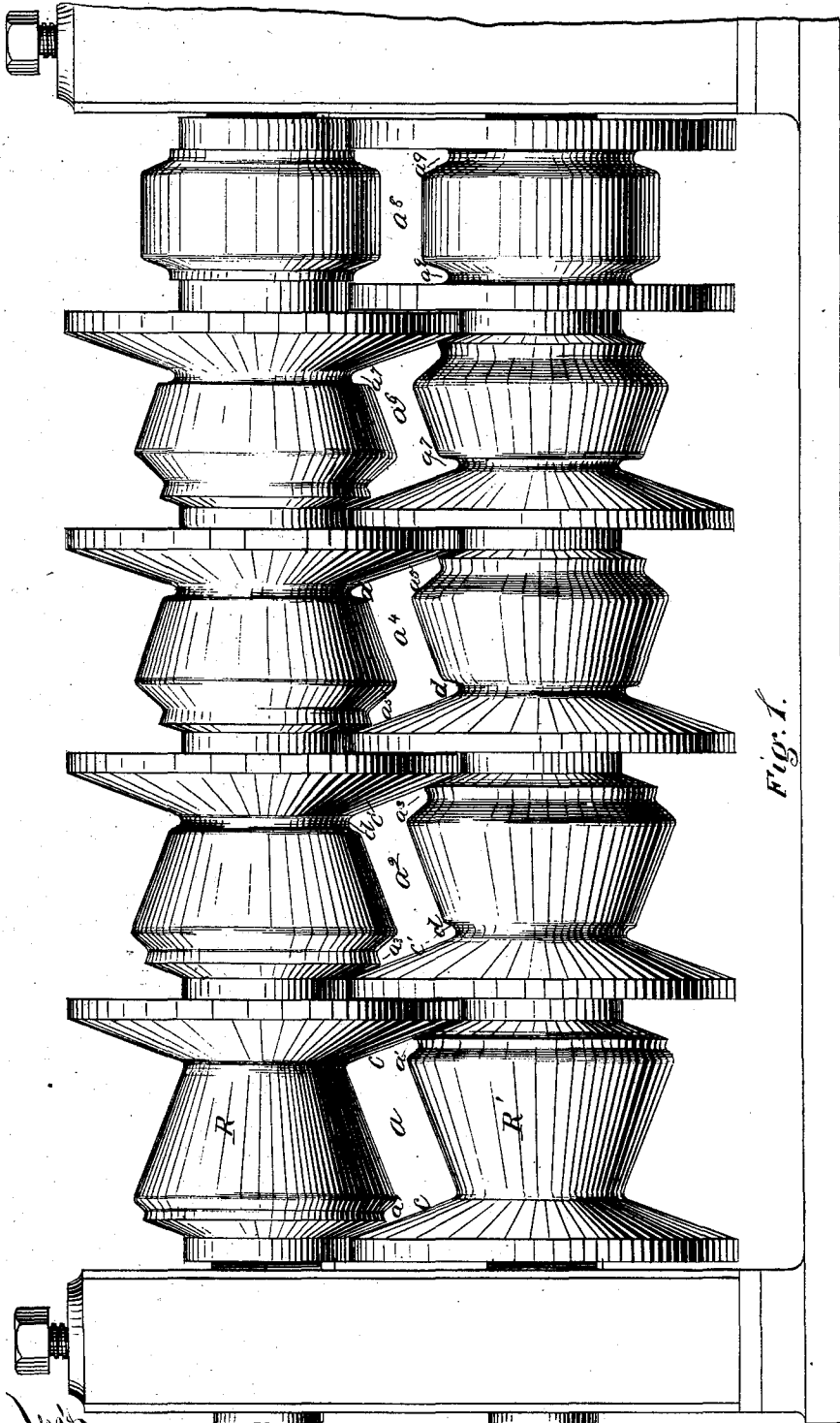


Fig. 1.

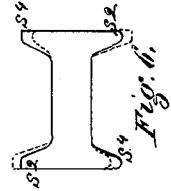


Fig. 6.

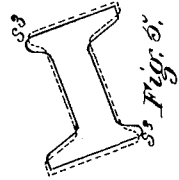


Fig. 5.

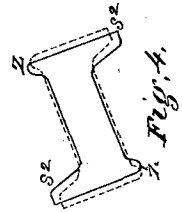


Fig. 4.

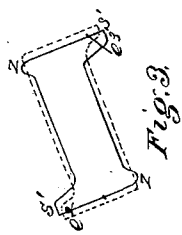


Fig. 3.

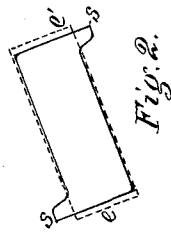


Fig. 2.

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# UNITED STATES PATENT OFFICE.

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## ROLLING STEEL BEAMS.

SPECIFICATION forming part of Letters Patent No. 244,811, dated July 26, 1881.

Application filed March 3, 1881. (No model.)

*To all whom it may concern:*

Be it known that I, ANTHONY C. KLOMAN, of Allegheny, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Rolling Steel I-Beams; 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 is a front view, in elevation, of a pair of rolls illustrative of the present invention; and Figs. 2 to 6 are outline diagram views of the shape of the bar or beam at successive stages of its manufacture, and illustrative of the changes of form effected by the different successive passes.

As is well known, there is a growing demand for steel as a substitute for iron for many structural purposes. Among other things a call is made for large steel I-beams.

Hitherto it has been found impracticable to make such large beams of steel—say from about eight-inch beams and upward—on account of the difficulty of getting the steel into an I-beam shape. It has been found impracticable to cast the ingot of the desired shape to a size such as when rolled out will give a large and long beam. Securing the shape by piling, as in iron-working, is also impracticable in steel, and the rolling of an I-beam by ordinary processes of rolling, direct from a steel ingot rectangular in cross-section, is commercially impracticable, except in a universal mill, and even then the work is difficult and costly.

In the accompanying drawings I have illustrated a pair of rolls by the use of which I am enabled to work a rectangular steel bar or billet into an I-beam form by a method which I believe to be new, the chief characteristic feature of which is the working of the steel in such manner that the bulk of the steel which goes to form the heads and flanges is first worked upwardly on one edge of the bar and downwardly on the other edge, so as to form two flanges on diagonally-opposite corners of the bar, each having an amount of metal in excess of what is required in each completed flange. After this is done the bar or billet is passed through grooves of such form that the edge metal is

worked in the reverse direction by a like operation, so as to form flanges on the other two corners. In this way I bring the billet or bar to an I-beam form, after which the billet is reduced and drawn down to the size required by a rolling operation such as is common in the ordinary rolling of iron I-beams of like size from properly-formed piles.

At R R', I have shown a pair of rolls having a system of grooves such as I employ. Assuming that the ingot has been rolled down to the form of a rectangular bar or billet of, say, sixteen (16) inches by six (6) in cross-section, (illustrated by dotted lines in Fig. 2, I give it a pass (properly heated) through the groove *a*, the form of which is such that the inclined walls *c c* shall work one edge, *e*, of the bar upwardly and the other end, *e'*, downwardly into the sub-grooves *a'*, so as to make a partial flange, *s*, on two diagonally-opposite corners of the bar. The bar may at the same time be slightly reduced in thickness—say about half ( $\frac{1}{2}$ ) of an inch. This first pass, it will be observed, by working the metal in the edges of the bar around to form the partial flanges *s*, narrows the bar about an inch. The bar then has the form substantially as represented by full lines in Fig. 2. It next goes through the groove *a*<sup>2</sup>, where, by identically the same operation, the bar is again narrowed, and the metal displaced in narrowing is worked around into the deeper sub-grooves *a*<sup>3</sup>, so as to increase to a corresponding extent the size of the partial flanges now marked *s'*. This is effected by the inclined walls *c'*, which at this pass work the edge *e*<sup>2</sup> of the bar, with its flanges, still farther upward, and the edge *e*<sup>3</sup>, with its flange, still farther downward, so as to enlarge such partial flanges, as indicated at *s'*, Fig. 3. At the same time, by the use of other sub-grooves, *d*, if so desired, the work of making the other two flanges may be commenced; but the amount of work which can thus be done in steel-rolling is comparatively small, and these sub-grooves *d d* may be used at this pass or omitted at pleasure, since I rely for the most part on the novel method already indicated for effecting the proper disposition of the metal.

Fig. 3 illustrates by dotted lines the form of the bar before this pass is made and by full lines its form after this pass is made. Also,

at this pass, as at the previous one, the middle part of the bar is slightly reduced in thickness, and the working around of the ends of the bar, as described, narrows it, say, about an inch. I then pass the bar or billet through the groove  $a^4$ , and in the same manner as already described still further narrow it, and to the extent of such narrowing work the excess of metal around upwardly on one edge and downwardly on the other, so as to still further enlarge the flange parts by working the metal into the sub-grooves  $a^3$ , and also, if desired, develop to a further extent, though but slightly, the beads  $z$ , which constitute a beginning of the other two flanges. In Fig. 4 the dotted line shows this form of the billet before and the full line after this pass is made.

This work may be carried on through any desired number of passes more or less than the number shown, but sufficient to give a body of metal in the flanges  $s^2$  so far corresponding in size to the rest of the billet at the end of the forming operation that all parts will roll down together. After this is done I pass the billet through a groove,  $a^5$ , in which still further reduction is made in the width of the billet; but the excess of edge metal displaced is worked in the reverse directions from that above described, so as to be forced into the sub-grooves  $a^4$ . It will be seen that in this operation the previously-formed flanges  $s^2$  remain substantially unchanged, except as a portion of the metal which has been used to form them is worked back in a reverse direction, and with other displaced metal is worked into the sub-grooves  $a^4$ , so as to form the other two partial flanges,  $s^3$ . In Fig. 5 the form of the billet before and after this pass is represented by dotted and full lines, as before. The partial flanges  $s^3$  may be filled out to a still larger size by being passed through another groove, which may sustain the same relation to  $a^5$  which  $a^4$  sustains to  $a^2$ ; but the same result may be secured by the use of a groove,  $a^6$ , so shaped as to reduce somewhat the flanges  $s^2$  and force the excess of metal in the heads over into the sub-grooves  $a^5$ , and thereby enlarge to a corresponding size the partial flanges  $s^3$  and bring them to the form shown at  $s^4$ . These forms are illustrated at Fig. 6, as before. The billet has now an I-beam form, such as is customary in iron-working, it may be drawn and reduced to the finished size.

While I have specified number and order of passes, sizes of bar or billet, dimensions and extent of reduction with some particularity, I have done so simply in order to explain the invention with the greater clearness, and not with any intent thereby to limit the scope of the invention.

The number of the passes may be varied at pleasure, as also the order—as, for example, after the first partial flanges  $s$  are formed, the body of metal in the edges of the bar, which was moved to form those partial flanges, may at the next pass, with further narrowing, be worked back in the reverse direction, so as to form two like partial flanges on the other two corners of the bar; and thus the work may go on by narrowing the bar at each pass by means of the inclined walls of the grooves, in such manner as on one pass to work the bulk of the metal displaced at the edges of the bar upwardly on one edge and downwardly on the other, and at the next pass in the opposite directions. And even if, by the use of small sub-grooves, as illustrated at  $d$ , a comparatively small amount of metal may at any one pass be worked out in a direction other than that thus designated for such pass, it will still remain true that the greater part of the useful effect will result from the working up and down of the edge metal in opposite directions on the opposite edges at the same pass and in reversed directions on different passes.

The sizes of the grooves and the amount of reduction at the different passes may be regulated by the skilled steel-worker. Also, the grooves may be arranged in different rolls, if so preferred, though, as I believe, less advantageously, unless a considerable number of grooves be required—say for large-sized beams.

I claim herein as my invention—

1. The method described of reducing a billet or ingot of steel rectangular in form in cross-section to a form approximately an I-beam—to wit, gradually working or drawing the mass of metal at the edges outwardly, first in one direction and then in the opposite direction, but always at right angles substantially to the face of the billet, thus reducing its breadth until masses of metal in sufficient quantity have been projected from the corners of the billet or ingot to form the heads or flanges of the beam.

2. A pair or pairs of rolls having series of diagonal grooves, substantially such as are indicated in the drawings by the letters  $a$   $a'$   $a^2$   $a^3$   $a^4$   $a^5$   $a^6$   $a^7$ , and the supplemental horizontal groove  $a^8$   $a^9$ , substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand.

ANTHONY C. KLOMAN.

Witnesses:

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GEORGE H. CHRISTY.