No. 608,380. Patented Aug. 2, 1898.

E. W. McKENNA.

METHOD OF AND MACHINE FOR ROLLING STEEL RAILS.

(Application filed Oct. 11, 1893. Renewed Dec. 24, 1894.)

(No Model.) 2 Sheets—Sheet 1.

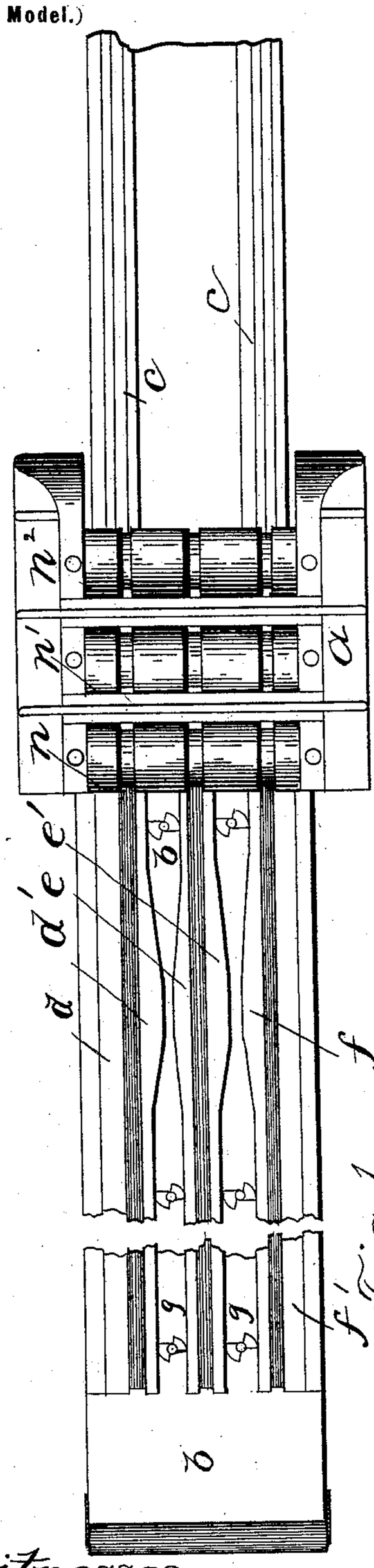

Fig. 1.

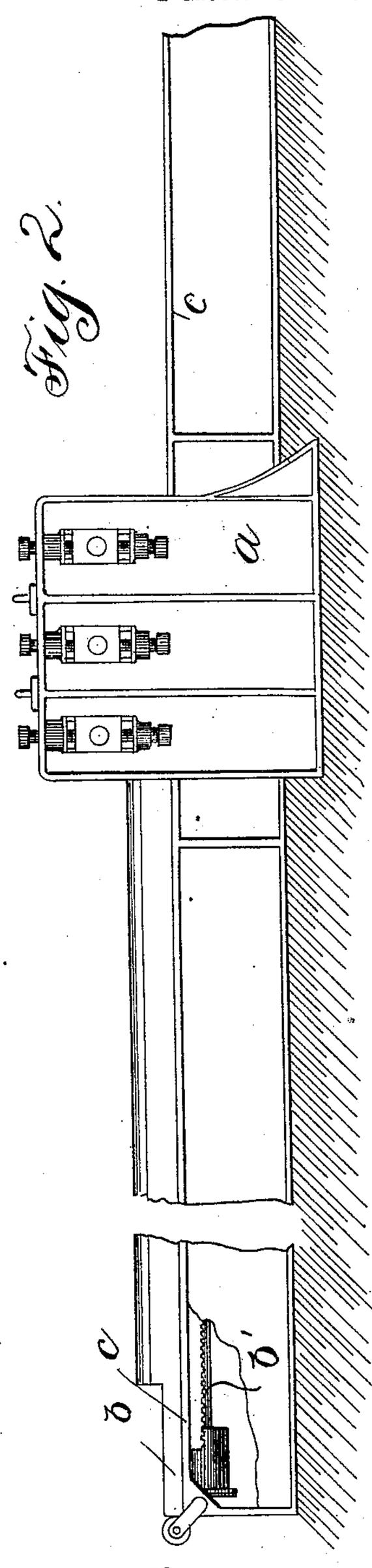

Fig. 2.

Witnesses
George L. Cragg
Ella Edler

Inventor
Edward W. McKenna
By Parton & Brown
Attorneys.

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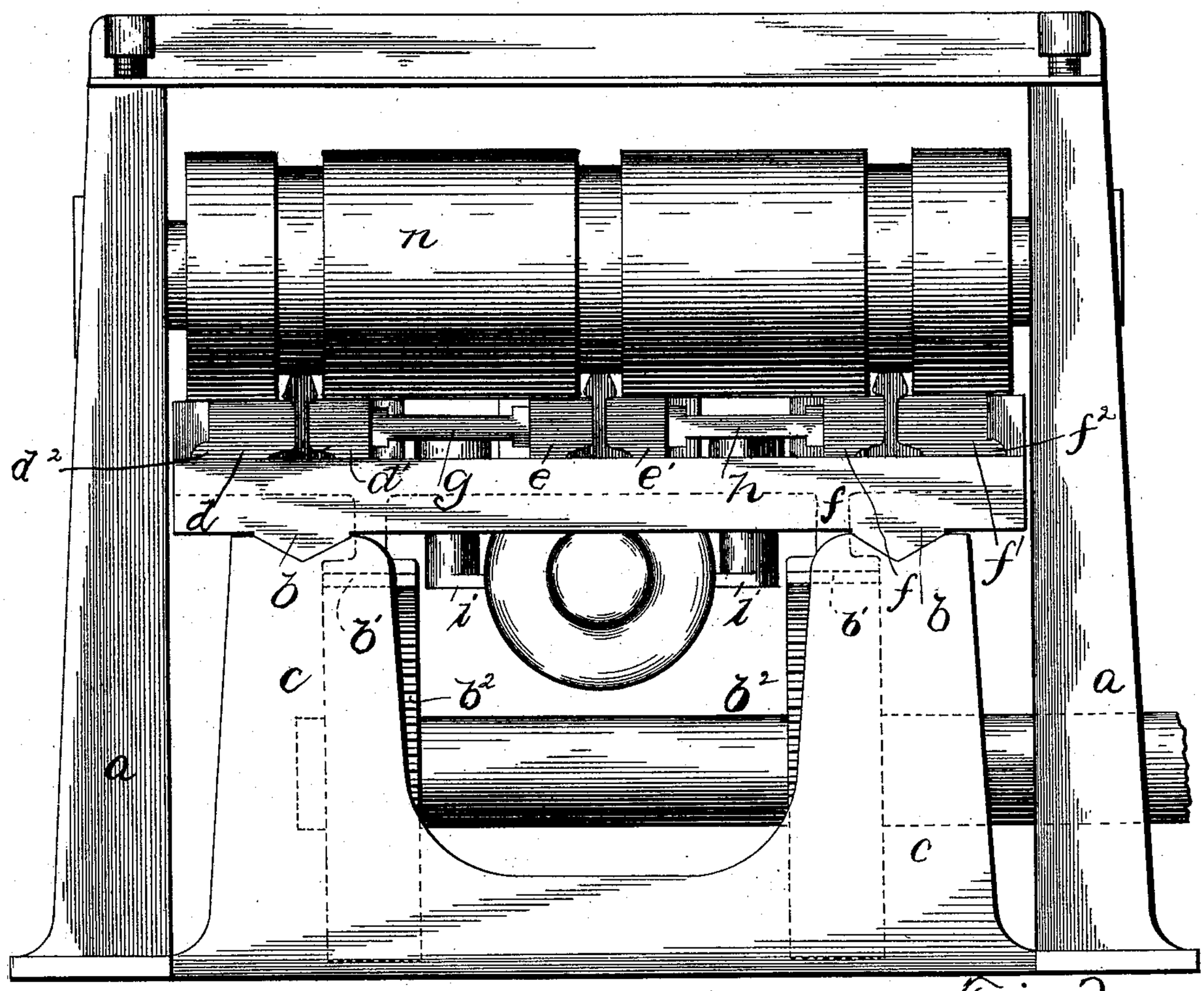

Fig. 3.

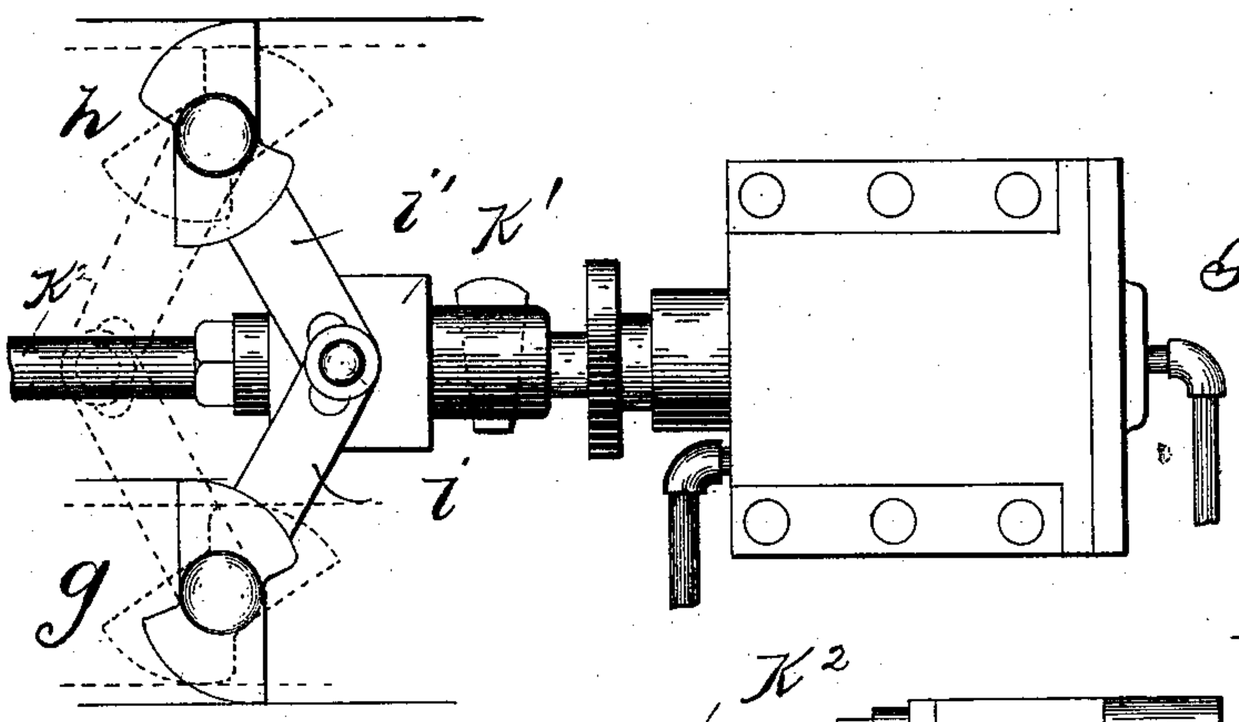

Fig. 4.

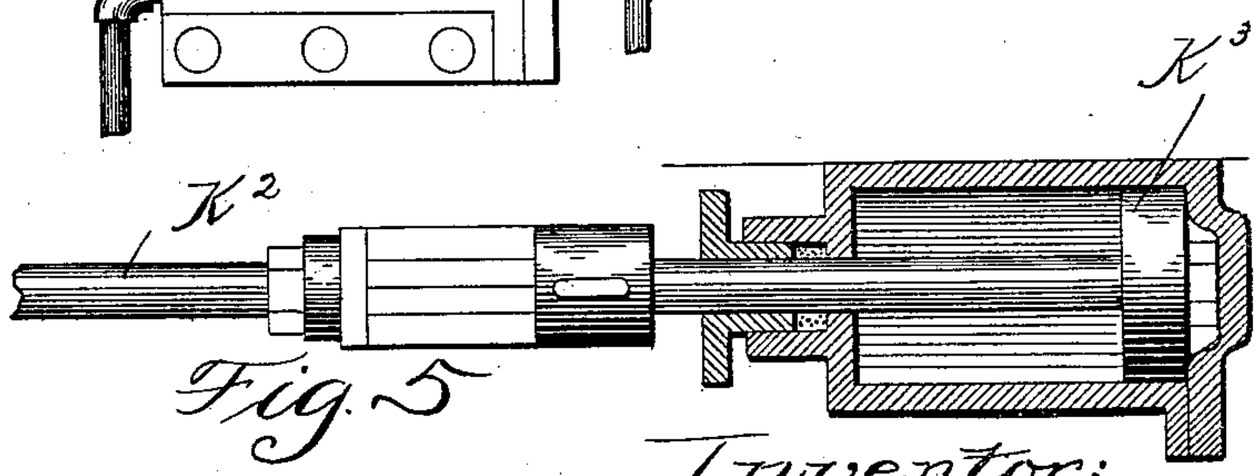

Fig. 5

Witnesses:
George L. Cragg.
Ella Edler

Inventor:
Edward W. McKenna
By Barton & Bowen
Attorneys.

UNITED STATES PATENT OFFICE.

EDWARD W. McKENNA, OF MILWAUKEE, WISCONSIN.

METHOD OF AND MACHINE FOR ROLLING STEEL RAILS.

SPECIFICATION forming part of Letters Patent No. 608,380, dated August 2, 1898.

Application filed October 11, 1893. Renewed December 24, 1894. Serial No. 532,890. (No model.)

To all whom it may concern:

Be it known that I, EDWARD W. McKENNA, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Methods of and Machines for Rolling Steel Rails, (Case No. 3,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to an improved method of rolling steel rails and to a machine for accomplishing this result.

It has been customary heretofore in rolling rails to pass the material from which the rail is formed through positively-driven rolls that reduce the cross-section of the stock in all parts, the rolling process being completed by the passage of the stock through these rolls.

In accordance with the present invention the rail is first shaped in ordinary positively-driven rolls, the web and flange portions of the rail being given the desired shape, but the head portion having imparted thereto a shape in which the width of the head or the upper portion thereof is less and the height is greater than the corresponding dimensions of the head of the completed rail. The rails after being thus rolled are removed to a machine, hereinafter more particularly described, in which the web and the flange portions of the rail are grasped between jaws and maintained practically intact during the operation while the height of the head is reduced, the metal being permitted to flow transversely, the operation being continued until the desired transverse and vertical dimensions of the head have been attained. Rails when so rolled are more durable and possess longer life than when rolled, as heretofore, by passing through the ordinary rolls. The result I attribute to the fact that the final rolling process consists in compressing the metal of the head in the direction of the line of work, the metal of the tread of the rail being thus rendered more compact, and thereby more resistant to wear. Furthermore, this rolling process taking place at a time when the rail is rapidly cooling, the effect of the vertical working of the metal is to densify the structure for some distance from the surface and impart a tough skin to the metal of the tread, thereby rendering the tread more effective against wear.

While passing through the ordinary rolls, I preferably impart to the head a truncated section, the lower portion of the head possessing a greater width than the upper portion. By thus shaping the head the metal of the lower part of the head does not require to be moved considerably in the final head-forming process, and forms a back against which the metal of the upper part of the head may be compressed.

The machine for accomplishing the head-forming process consists, in its preferred form, of a traveling carriage provided with jaws adapted to grasp the web and flange of the rail, the carriage being then impelled forward, whereby the head of the rail is passed successively through rolls that properly form the same, rotation being imparted to the rolls by the friction of the rail in passing therethrough.

My invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a plan view of the machine of my invention, a portion thereof being shown as broken away. Fig. 2 is an elevational view thereof. Fig. 3 is an end view of the machine. Fig. 4 is a plan view of the cams that actuate the jaws for clamping the rails and of the mechanism that actuates the cams. Fig. 5 is an elevational view, partly in section, of a portion of the mechanism shown in Fig. 4.

Like letters refer to like parts throughout the several figures.

The machine comprises a standard or housing *a*, supporting the rails, and a traveling carriage *b*, traveling in V-shaped ways provided in the frame or bed *c* of the machine. The traveling carriage supports upon its upper surface the jaws for clamping the rails. In the drawings a machine having capacity for handling three rails at a time is illustrated; but any desired number of rails may be handled at a time, determined by the desired capacity of the machine. Upon the under surface of the carriage are provided racks b' b', which engage with gear-wheels b^2 b^2, driven first in one direction and then in the other to effect the reciprocal travel of the carriage in

a well-known manner. The jaws $d\ d'$, $e\ e'$, $f\ f'$, between which the rails are clamped, extend throughout the length of the carriage, which is preferably sufficient to accommodate thirty-foot rails—the standard length. The outer jaws d and f' of the outer pairs are made stationary, while all of the others are made transversely movable, said stationary jaws being provided with lips d^2 and f^2, that engage with corresponding channels in the carriage for securely maintaining said jaws in position. The transverse movement of the remaining jaws is effected by the cams g and h, which are adapted to rotate about vertical axes, each cam comprising a pair of leaves arranged on either side of the axis of rotation, the peripheries of the leaves being arcs of circles eccentric to the axis of rotation or other curves possessing a varying radius of curvature. These cams are located between the adjacent jaws of adjacent pairs, and when they are so turned that the edges of the jaws engage with those portions of the cams nearest the axis of rotation the jaws are opened and the rails may be inserted or withdrawn, while if the cams be so turned that the edges of the jaws engage with portions of the cams more distant from the center the jaws of the respective pairs are caused to approach and clamp the rails. I preferably employ five such pairs of cams located at distances along the jaws, and in order to prevent bending of the jaws at points between the locations of the cams the portions of the jaws intermediate between the cams are made of an increased transverse dimension.

The journals upon which the cams rotate extend downward through the bed of the carriage b and are provided with arms $i\ i'$, rigidly secured thereto or formed integral therewith. The slotted ends of said arms engage with a pin k, provided upon the reciprocating cross-head k'. When the cross-head is in the position shown in full in Fig. 5, the cams are so rotated that the jaws are caused to engage with the portions of the cams of greatest radius of curvature, and in consequence the jaws are pressed apart and the rail is thereby clamped. When the arms $i\ i'$ have been moved by the travel of the cross-head to the left to the position indicated in dotted lines, the cams are rotated until the engaging surfaces of the cams become those of less radius of curvature, and the edges of the engaged jaws may be brought toward one another. The piston-rod k^2, upon which are mounted the several cross-heads that control the movements of the cams, is secured to a piston k^3, that may be actuated by water, steam, or in any preferred manner, the driving fluid being conveyed to the cylinder through flexible pipes or by a sleeve-pipe, but an expedient whereby fluid may be conveyed to a moving cylinder being old and forming no part of my present invention in its individual capacity I have omitted it from the drawings for clearness.

In the operation of the cams it is necessary that the force causing the approach of the jaws to clamp the rail be checked when the rails have been securely clamped, as otherwise the whole of the rail being heated the tendency would be to compress the web and flange and distort the shape of the rail. This checking may be accomplished by providing means for cutting off the motive fluid when the piston has traveled a definite distance by counterbalancing the pressure on the piston by a gradually-increasing force or in any preferred manner; but as this forms no part of my present invention in its individual capacity I have not deemed it necessary to illustrate this feature.

The jaws are so shaped upon their faces that they conform to the shape of the flange and web portion of the rail, while the upper surfaces of the jaws are proportioned to conform to the proper shape of the under surface of the head of the rail.

The heads of the rails pass successively through peripheral channels provided in the horizontal rolls $n\ n'\ n^2$. The width of each channel I preferably make equal to the desired width of the head of the completed rail, while the depths of the channels vary, the depth of each being somewhat greater than the depth of that of the succeeding rolls. The head of the rail having been rendered greater in height than the desired height of the completed rail in passing through the ordinary rolls, the first roll n serves to slightly reduce the height of the head of the rail, pressing the metal to the side, thus increasing the width of the head. The next roll serves to still further decrease the height and increase the width of the head, while the last roll, which is completely filled by the metal of the head in its passage, imparts to the head the proper height and width and the proper shape.

Although preferable, it is of course not essential that the width of the channels in all of the rolls before the last be equal in width to the desired width of the completed rail, and the several widths may be so arranged relatively to the decrease in the height that the head will completely fill each channel as it passes therethrough.

It will be observed that the machine above described, by the insertion of proper jaws and rolls, may be used for rolling rails of various standard shapes, and in fact may be used in any case where it is desired to roll but one particular section of a beam or other rolled piece of metal, maintaining meanwhile the remaining section or sections practically intact.

It is evident that the machine as above described may be varied in various mechanical features, all of which I consider within the scope of my invention, broadly considered, and I do not therefore desire to limit myself to the precise construction herein shown.

In applications, Serial Nos. 487,975 and

487,976, concurrently pending herewith I have shown and claimed specific adaptations of the general features of the machine described herein, and I consider both of said applications subsidiary hereto.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The herein-described process of forming rails, which consists in heating the metal, rolling the web and flange portions of the rails to practically the dimensions desired in the completed rail while forming the head with a cross-section of greater height and less width than is desired in said completed rail, and thereafter bringing the head to its final shape while cooling by pressure applied in the direction of the line of work, thus altering the vertical and horizontal dimensions of the head and constraining the metal of said head from lateral flow upon either side of and at the point at which said pressure is applied.

2. The process of forming rails, which consists in heating the metal, rolling the web and flange portions to practically the sizes desired in the completed rail while forming the head of less width and greater height than the desired dimensions of said completed rail, constraining the web and flange of the rail substantially throughout its length while maintaining the said parts practically intact, and rolling the head portion while cooling in the direction of the line of work to alter both its vertical and horizontal dimensions, thereby bringing said head to the desired shape, substantially as described.

3. The process of rolling rails, which consists in heating the metal, rolling the web and flange portions to practically the sizes desired in the completed rail, while giving the head a truncated form of less width and greater height than the desired dimensions of said completed rail, then bringing the head to the desired shape while cooling by pressure applied thereto in the direction of the line of work, meanwhile maintaining the web and flange portions of the rail practically intact and constraining said rail against warping or bending approximately throughout the length thereof, substantially as described.

4. In a machine for operating upon rolled metal, the combination with rolls adapted to act upon one section of the metal, of a traveling carriage provided with jaws adapted to grasp the metal and maintain the remaining section or sections practically intact during the rolling of said first-mentioned section, substantially as described.

5. In a machine for rolling rails, the combination with means for applying pressure to the head of the rail, of a traveling carriage provided with jaws adapted to grasp the rail and maintain the remaining sections practically intact during the rolling of said first-mentioned section, substantially as described.

6. In a machine for rolling rails, the combination with means for applying pressure to the head of the rail adapted to shape the said head, of a traveling carriage provided with jaws adapted to clamp the lower portion of the rail, said jaws being provided with faces adapted to conform to the outlines of the web, flange and under surface of the rail-head, substantially as described.

7. In a machine for rolling steel rails, the combination with means for advancing the rail, of rolls adapted to act upon the top of the head of the rail, and means for imposing against the sides of the rail-head plane surfaces extending for a distance to the front and to the rear of the line of contact of the roll to constrain the lateral flow of the metal of the head, substantially as described.

In witness whereof I hereunto subscribe my name this 11th day of October, A. D. 1893.

EDWARD W. McKENNA.

Witnesses:
JNO. I. SABIN,
N. L. COLLAMER.