(No Model.)

# J. T. RICHARDSON & A. RAPP.

## ROLLING MILL.

No. 383,990. Patented June 5, 1888.

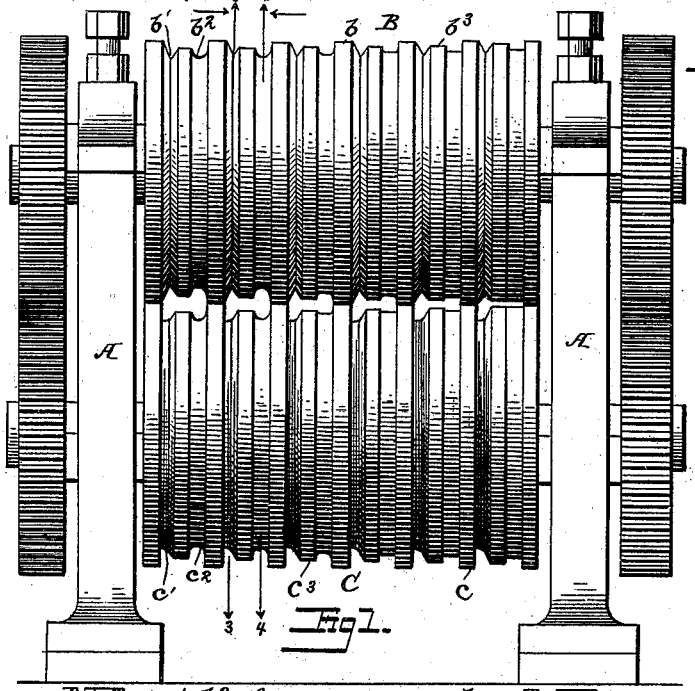



Fig. 1.

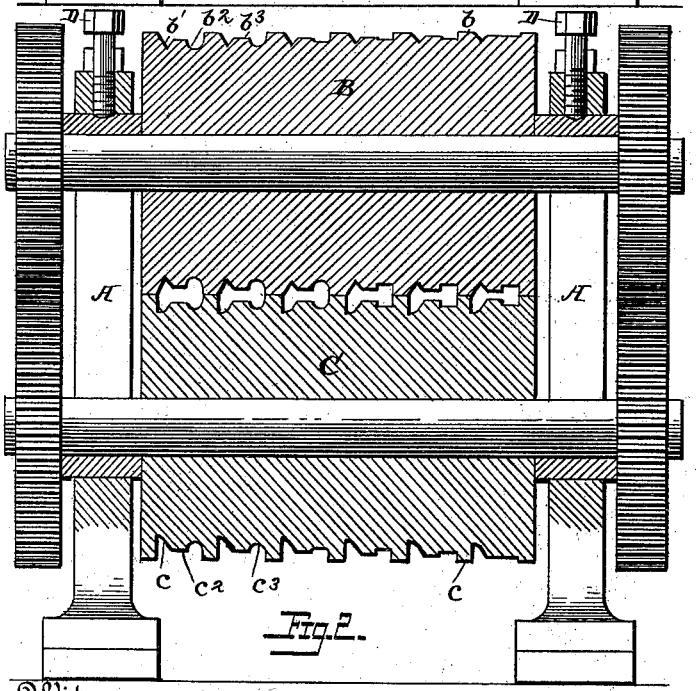



Fig. 2.

Fig. 3.

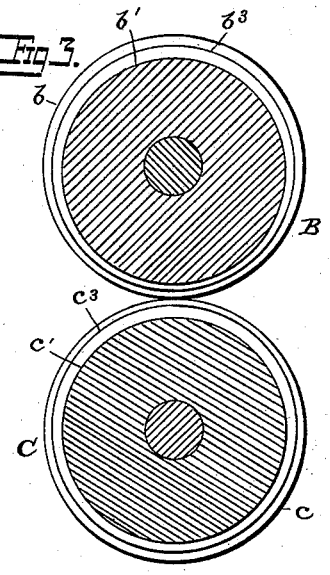
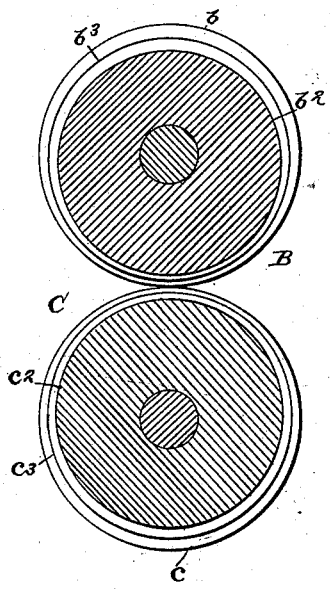



Fig. 4.

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# UNITED STATES PATENT OFFICE.

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## ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 383,990, dated June 5, 1888.

Application filed December 16, 1887. Serial No. 258,099. (No model.)

*To all whom it may concern:*

Be it known that we, JOHN T. RICHARDSON and AARON RAPP, citizens of the United States, and residents of Harrisburg, Dauphin county, Pennsylvania, and Holland, Hunterdon county, New Jersey, have invented certain new and useful Improvements in Rolling-Mills, of which the following is a specification.

Our invention relates to rolling-mills intended for rolling tapering articles; and it consists in forming the reducing-face of one or both of a pair of rolls with a series of grooves or ribs, or both combined, arranged eccentrically relative to the axis of their roll; and our invention relates more particularly to rolls adapted to form the point-rails of split railway-switches, the object being, when such articles are being produced, to impart to the bar of metal being reduced the peculiar taper required by such rails, while at the same time preserving a uniform or substantially uniform width and size throughout to the outer bottom flange of the rail, as is usual; and to this end a pair of reducing-rolls is provided with peripheral grooves and ribs arranged as will be hereinafter described, certain of the grooves and ribs being eccentric relative to the axes of their respective rolls and so related to each other that the space between them shall be gradually contracted as the rolls revolve, while the grooves which roll the outer flange of the rail are concentric with the axis of its roll and of uniform depth throughout.

In the drawings, Figure 1 is a side elevation of a pair of rolls embodying our invention in the position of the least separation between their reducing-faces. Fig. 2 is a longitudinal section of the rolls in the position of the greatest separation between their reducing-faces. Fig. 3 is a vertical transverse section on the line 3 3, Fig. 1. Fig. 4 is a similar section on the line 4 4, Fig. 1.

A A represent suitable standards, in which are journaled in any approved manner a pair of rolls, B C, the upper roll, B, being held into operative position in respect to the lower one, C, in boxes adjusted by means of the set-screws D, or other equivalent devices. The rolls are suitably geared together, so as to be driven in unison, for which purpose any well-known or preferred mechanism may be employed which may be quickly stopped and started and easily reversed. The two rolls are provided with a series of reducing-faces separated by comparatively narrow ridges or surfaces $b$ $c$, which are opposed to each other and which may, if desired, roll in contact. The reducing rolling faces are given the proper configuration to effect the reduction required by means of grooves and ribs, the grooves in the upper roll being lettered $b'$ $b^2$ and the rib $b^3$, while opposed to these, respectively, are the grooves $c'$ $c^2$ and the rib $c^3$, formed in the lower roll.

With the exception of grooves $c'$, all reducing portions of the rolling-faces on the respective rolls are eccentric to their axes of rotation. The portions of greatest eccentricity of all the reducing-surfaces on one roll are preferably in the same longitudinal line parallel with the axis of the roll, as also are the portions of least eccentricity preferably on another line, also parallel with the axis of the roll—that is, the eccentric portions of the reducing-faces by preference all spring from the same line and all end on another line—while the two rolls are so geared together that the portions of greatest eccentricity and least eccentricity on the two rolls shall be opposed to each other as they revolve.

While the grooves $b'$ $b^3$ and the ribs $b^2$ on roll B, (and also the grooves $c^3$ and ribs $c^2$ on roll C,) are all eccentric, and their greatest and least eccentricities are in the same transverse lines, the degree of eccentricity of the ribs and grooves on either roll varies, the variation being greatest at the lines of their least eccentricity and gradually reducing in extent to the lines of the greatest eccentricity, these features being best illustrated in the transverse sectional views, Figs. 3 and 4.

The circumferential size of the rolling grooves and ribs $b'$, $b^2$, and $b^3$ and $c^2$ and $c^3$ and the relation thereof to each other varies between each pair of ridges $b$ $c$ progressively in the direction of the length of the rolls, so that the rail is gradually reduced as it passes successively between the different rolling-faces, as is common in this class of machines. The

grooves $c'$, on the other hand, are concentric with the axis of their roll and are all of uniform circumferential size and depth, so that that portion of the rail engaged thereby, which is the outer lower rail-flange, is not reduced or caused to taper, as are the other portions of the rail.

The shoulders or edges of the eccentric grooves and ribs are rounded or beveled in order to better effect the reduction of the rail and give thereto the required taper both of head, web, and flanges, the former (the head of the rail) being given a regular elongated taper solely by the grooves $b^3$ and $c^3$, while the inner flange is upset and doubled back laterally upon the web of the rail during the process of rolling by the groove $b'$, and the web is tapered by the ribs $b^2$ and $c^2$.

The circumferential size of the rolls will be varied to suit the length of taper of rail to be rolled, and may be such that a complete revolution of the rolls will be required to pass the tapered portion of the rail entirely through between them. We prefer, however, that the size of the rolls shall be such that a semi-revolution thereof shall give the proper reduction to the rail, and such is the construction we have illustrated.

The degree of acuteness of the taper given to the rail will be determined by the required length of "lead" in any designated case, and the degree of eccentricity of the reducing-faces will be accordingly changed.

As the rolls should stop in such relation to each other as that their bearing-faces shall all be most widely separated, the necessity of quickly and easily operating stopping and starting mechanism, which preferably should be automatic, will be apparent. When the rolls are given but a semi-revolution to effect the reduction of the rail, a positively and quickly-acting reversing mechanism must be employed—as, for instance, the ordinary link-motion—which may be automatically operated by a steam, pneumatic, or hydraulic piston.

Since the rail-points or tapering rails produced by a machine embodying our invention should taper in one direction when used in certain positions and in the opposite direction for other positions, it is necessary that the rolls should be arranged so that the rails may be passed between them from either side.

The blank rails intended to be produced by the rolls described are first given the ordinary T-form by any suitable style of machinery and cut into the proper lengths. They are then passed successively between the series of rolling reducing-faces while lying horizontally on their sides, the rolls starting each time from the positions of greatest separation between the rolling-faces.

It will be apparent that our invention admits of more or less variation from the construction which we have chosen as a means of illustrating the same in the drawings. For instance, the rolls may each be provided with but a single rolling-face, a series of rolls being employed, if found necessary, instead of a pair with a series of reducing-faces. It is also evident that our invention is not limited to the particular use for which we have described and shown it, as other articles having a tapering form might be formed thereby, in which event it might be necessary to vary the number and relation of the ribs and grooves. It may be also suggested that our invention may be embodied in connection with rolls neither of which is provided with a concentric groove; or if such concentric groove be employed, a construction in which they, while remaining concentric with the axis of the roll, yet vary in size or diameter; or the roll may be arranged with its rolling ribs and grooves concentric throughout one half or other part of the circumference and arranged throughout the remainder of the circumference to give a tapering form to the rail, so that part of the rail shall maintain the ordinary T form, while the remainder shall taper.

We claim—

1. In a rolling-mill, the combination, with a roll, of an opposing reducing-roll, B, provided with a reducing-face having eccentrically-arranged grooves and eccentrically-arranged ribs, substantially as described.

2. In a rolling-mill, the combination, with a roll, of an opposing reducing-roll, B, provided with a reducing-face having eccentrically-arranged grooves and eccentrically-arranged ribs, the degree of eccentricity of the grooves and of the ribs varying, substantially as described.

3. In a rolling-mill, the combination, with a roll, C, of an opposing reducing-roll, B, provided with a reducing-face having grooves and ribs both eccentrically arranged relatively to the axis of the roll, the least eccentricity and the greatest eccentricity of all of such grooves and ribs coinciding on the same lines parallel with the axis of the roll, substantially as described.

4. In a rolling-mill, the combination of the roll B, provided with a rolling-face having one or more grooves and ribs eccentrically arranged relatively to the axis of the roll, the lines of least and greatest eccentricity coinciding, and the roll C, having a rolling-face opposed to the rolling-face on roll B, and provided with grooves and ribs opposed to the grooves and ribs on rolls B, and arranged eccentrically to the axis of their roll, the lines of least and greatest eccentricity coinciding, the two rolls being geared together to bring the lines of least and greatest eccentricity of the ribs and grooves on their respective rolls opposite each other as the rolls are revolved, substantially as set forth.

5. In a rolling-mill, the combination, with a roll, C, of an opposing roll, B, provided with a rolling-face having one or more eccentrically-arranged grooves and eccentrically-arranged ribs, the least and the greatest eccentricity of such grooves and ribs coinciding on different lines parallel with the axis of the roll,

while the degree of eccentricity varies, substantially as and for the purpose set forth.

6. In a rolling-mill, the combination of the roll B, provided with a rolling-face having one or more eccentrically-arranged grooves and ribs, and a roll, C, having one or more eccentrically-arranged grooves and ribs opposed to the eccentrically-arranged grooves and ribs on the roll B, and having a groove concentric with the axis of said roll, substantially as set forth.

7. In a rolling-mill adapted to form tapering rails for railway-switches, the combination of the roll B, provided with a rolling-face having the eccentrically-arranged grooves $b'$ $b^3$, and rib $b^2$ between said grooves, the greatest eccentricity of said grooves and ribs coinciding on a line parallel with the axis of the roll, and the roll C, having a rolling-face opposed to the rolling-face of roll B, and provided with the eccentrically-arranged groove $c^3$ and rib $b^2$, and the concentrically-arranged groove $c'$, substantially as described.

8. In a rolling-mill adapted to form tapering rails for railway-switches, the combination of the roll B, provided with a series of rolling-faces having eccentric grooves $b'$ $b^3$ and ribs $b^2$, the diameter and degree of eccentricity of said grooves and ribs varying progressively with each of the series of rolling-faces in the direction of the length of the roll, and the roll C, having a series of reducing-faces opposed to those on the roll B, and having the eccentric grooves $c^3$ and ribs $c^2$ and the concentric grooves $c'$, the diameter and degree of eccentricity of ribs and grooves $c^2$ $c^3$ varying progressively in the direction of the length of the rolls, while the diameter or depth of groove $c'$ remains uniform, substantially as set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

JOHN T. RICHARDSON.
AARON RAPP.

Witnesses:
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C. S. THUMMA.