(No Model.) 3 Sheets—Sheet 1.

W. C. WOOD & J. W. WATSON.

GIRDER RAIL ROLLS FOR ROLLING MILLS.

No. 454,244. Patented June 16, 1891.

Fig. 1.

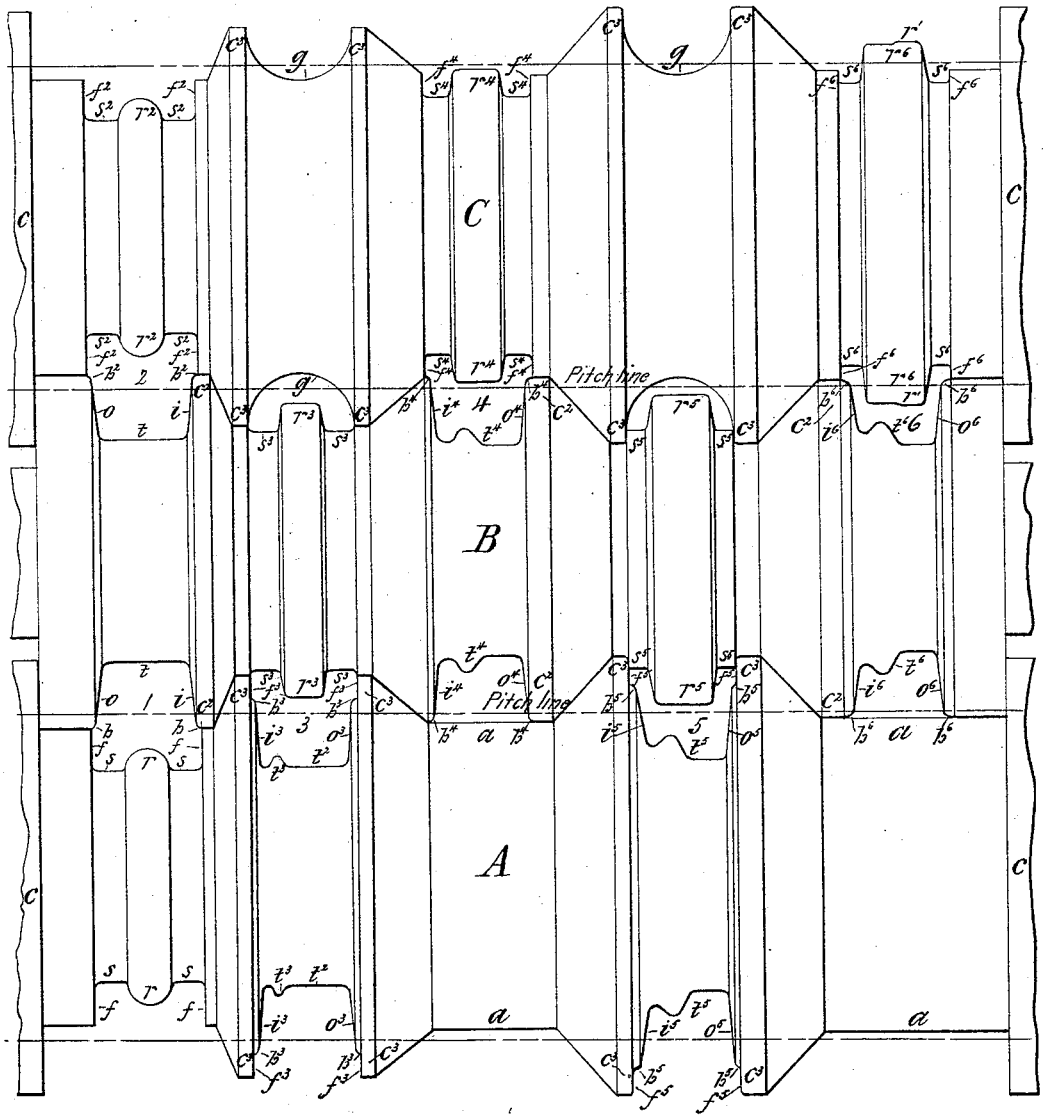

Fig. 1a

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GIRDER RAIL ROLLS FOR ROLLING MILLS.

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Fig. 2.

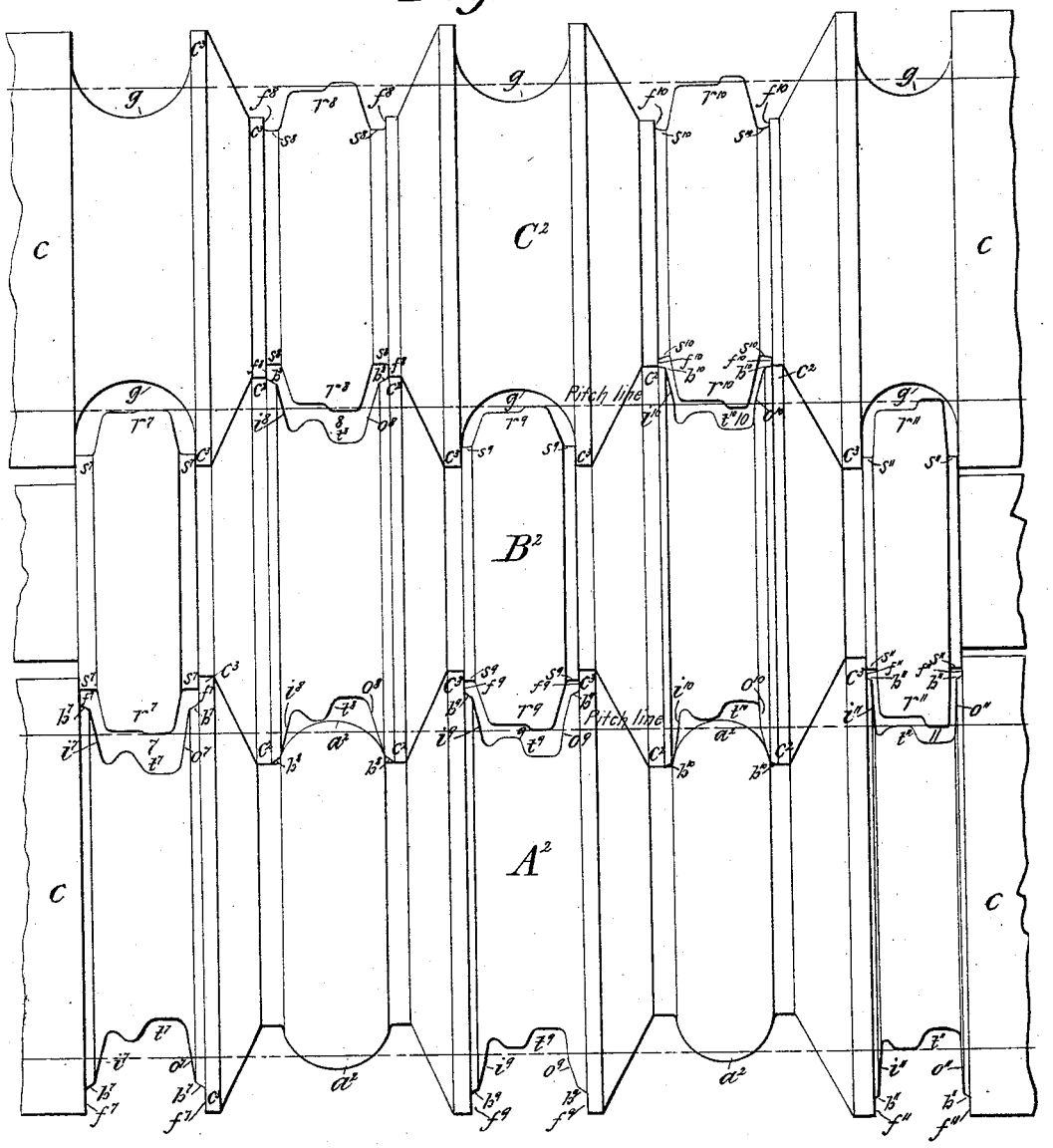

Fig. 2ª.

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(No Model.) 3 Sheets—Sheet 3.

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GIRDER RAIL ROLLS FOR ROLLING MILLS.

No. 454,244. Patented June 16, 1891.

Fig. 3.

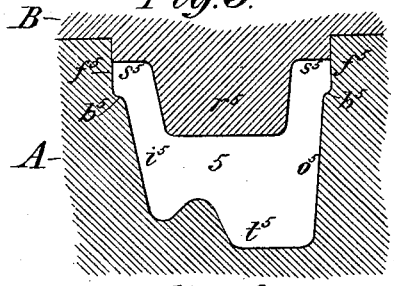


Fig. 4.

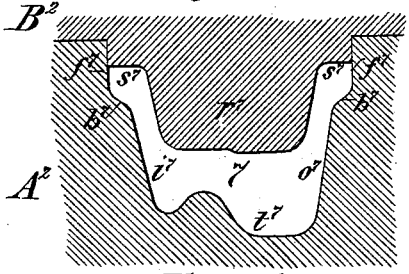


Fig. 5.

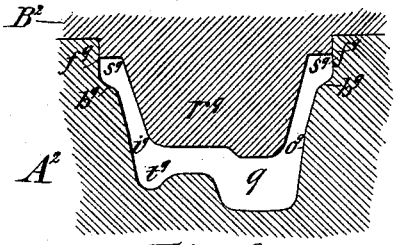


Fig. 6.

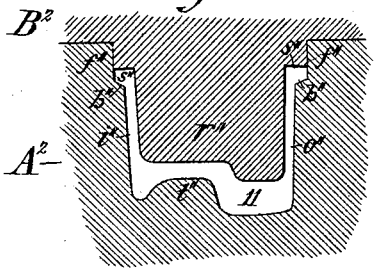


Fig. 7.

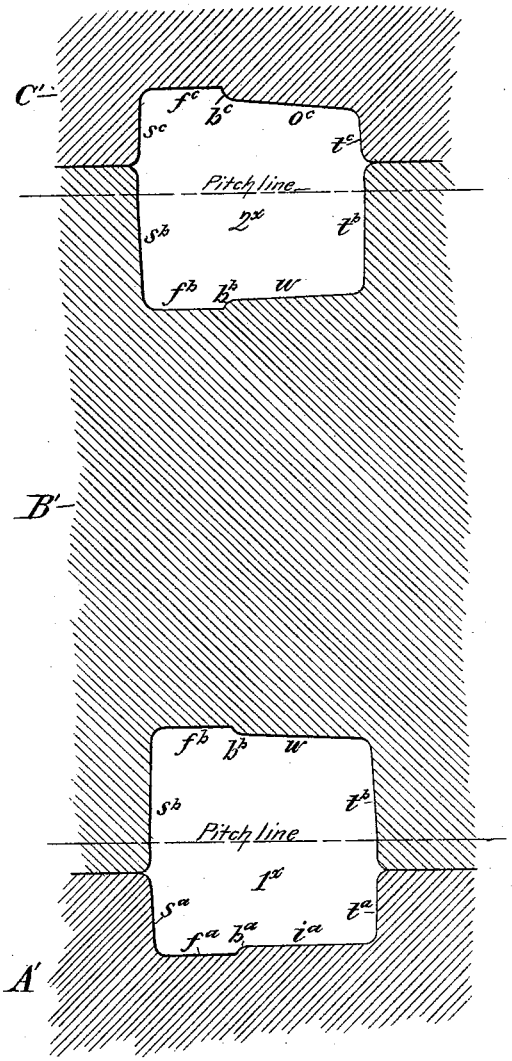


Fig. 8.

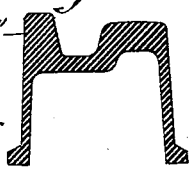
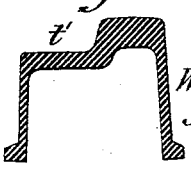


Fig. 9.



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UNITED STATES PATENT OFFICE.

WILLIAM C. WOOD, OF BROOKLYN, NEW YORK, AND JAMES W. WATSON, OF CHESTER, PENNSYLVANIA, ASSIGNORS TO THE LEWIS & FOWLER GIRDER-RAIL COMPANY, OF BROOKLYN, NEW YORK.

GIRDER-RAIL ROLLS FOR ROLLING-MILLS.

SPECIFICATION forming part of Letters Patent No. 454,244, dated June 16, 1891.

Application filed November 13, 1890. Serial No. 371,331. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM CLARK WOOD, of Brooklyn, in the State of New York, and JAMES W. WATSON, of Chester, in the State of Pennsylvania, have jointly invented a new and useful Improvement in Girder-Rail Rolls for Rolling-Mills, of which the following is a specification.

This invention relates, primarily, to three-high rolling-mill trains and to means for producing certain "box" rails invented and designed by the said William Clark Wood for the Lewis & Fowler Girder-Rail Company.

The present invention consists in certain novel features of construction and combinations of peculiarly-constructed passes, as hereinafter fully set forth.

The objects of the invention are, first, to begin the shaping of the beveled flanges of said box-rails at or about the first pass and to continue the same throughout the series of passes, so as to perfectly shape and condense such flanges; secondly, to roll the elastic webs flaring, so that they may be acted upon internally by a shaping-collar up to and including the final pass, in order to render such webs at once true, of the desired set, and of maximum strength; thirdly, to roll in or obliterate the parting-line fins at alternate passes, so that the metal in the web-flanges shall be homogeneous and their edges sharp and clean, and, fourthly, to obviate turning the cobble after the second pass, or thereabout, so as to facilitate handling it and to lessen the danger of accidents thereto.

Three sheets of drawings accompany this specification as part thereof.

Figure 1 of the drawings is an elevation of the roughing-down rolls of a three-high train embodying this invention. Fig. $1^{\times}$ is a cross-section of a suitable bloom on the same scale. Fig. 2 is an elevation of the finishing-rolls of the same train. Fig. 2^{z} is a cross-section of the final product on the same scale. Figs. 3, 4, 5, and 6 are sectional views showing, respectively, the fifth, seventh, ninth, and eleventh passes of the train on a larger scale. Fig. 7 is a sectional view showing the first and second passes of modified roughing-down rolls on the same scale; and Figs. 8 and 9 are cross-sections, on a like scale, of different patterns of the same system of box-rails, illustrating additional modifications.

Like letters and numerals of reference indicate corresponding parts in the several figures.

Our girder-rail rolls are preferably adapted to be worked in a three-high train comprising roughing-down rolls and finishing-rolls, coupled together end to end and driven continuously in customary manner. They are so represented in the drawings, and the following description will be confined to this arrangement. The particular rolls shown in Figs. 1 and 2 will be first specifically described, and certain proposed modifications and the features and combinations claimed as our invention will then be pointed out. The three roughing-down rolls A B C, Fig. 1, form the first six passes, which are consecutively numbered in the drawings 1 to 6, and the three finishing-rolls A^2 B^2 C^2, Fig. 2, form five more passes, numbered 7 to 11. The first pass receives a suitably-heated bloom, Fig. $1^{\times}$, say, six by eight inches in rectangular cross-section, as represented by the figure, and converts it at once into a cobble of approximately the outer shape of the final product, except as to the tread, by flange-defining shoulders *f f*, sole-defining surfaces *s s*, and a recessing projection *r* within a shaping-groove in the bottom roll A, and top and inner and outer side-defining surfaces (marked respectively *t*, *i*, and *o*) and beveling-surfaces *b*, within and adjoining a matching-groove in the middle roll B. The second pass is formed immediately above the first by the same groove and beveling-surfaces in the middle roll B and like flange-defining shoulders f^2 and sole-defining surfaces s^2, and a like recessing projection r^2 within a slightly shallower matching-groove in the top roll C. The third pass comprises top and side defining surfaces t^2 i^3 o^3, flange-defining shoulders f^3, and beveling-surfaces b^3 within a deep groove in the bottom roll A, said top-defining surfaces including a curvilinear projection t^3, whereby the rail-top begins to receive its distinctive shape, and a recessing projection r^3, protruding between shallow depressions which form sole-defining surfaces s^3 in the middle roll B. The fourth pass comprises top-shaping and side-defining surfaces t^4 i^4 o^4 and bev-

eling-surfaces b^4 within and at a shaping-groove in the middle roll B and flange-defining shoulders f^4, sole-defining surfaces s^4, and a recessing projection r^4 within a matching-groove in the top roll C. The fifth pass, Figs. 1 and 3, is formed by means of a deep groove in the bottom roll A and a shaping-collar on the middle roll B, said groove comprising top-shaping and side-defining surfaces t^5 i^5 o^5, flange-defining shoulders f^5, and beveling-surfaces b^5, and said collar comprising a recessing projection r^5 and sole-defining surfaces s^5. The sixth pass, Fig. 1, is formed by grooves in the middle roll B and top roll C, respectively, the deeper groove in the middle roll comprising top-shaping and side-defining surfaces t^6 i^6 o^6 and beveling-surfaces b^6, while the shallower groove in the top roll comprises flange-defining shoulders f^6 and sole-defining surfaces s^6, and the recessing projection r^6, protruding therefrom, is constructed with a prominence r' at one edge, whereby the distinctive shape of the interior of the rail is initiated. The seventh pass, Figs. 2 and 4, is formed in the finishing-rolls, as aforesaid, by a deep groove in the bottom roll A^2, comprising top-shaping and side-defining surfaces t^7 i^7 o^7, flange-defining shoulders f^7, and beveling-surfaces b^7, and a shaping-collar on the middle roll B^2, comprising a recess-developing projection r^7 and sole-defining surfaces s^7. The eighth pass, Fig. 2, is formed by grooves in the middle roll B^2 and top roll C^2, respectively, and a recess-developing projection r^8 within the top-roll groove, the deeper groove in the middle roll comprising top-shaping and side-defining surfaces t^8 i^8 o^8 and beveling-surfaces b^8, and the shallow groove in the top roll comprising flange-defining shoulders f^8 and sole-defining surfaces s^8. The ninth pass, Figs. 2 and 5, is formed by a deep groove in the bottom roll A^2 and a shaping-collar on the middle roll B^2, said groove comprising top-shaping and side-defining surfaces t^9 i^9 o^9, beveling-surfaces b^9, and flange-defining shoulders f^9, and said collar comprising a recess-developing projection r^9 and sole-defining surfaces s^9. The tenth pass, Fig. 2, is formed by a collar on the middle roll B^2 and depressions in the top roll C^2, together with a recess-developing projection r^{10}, which protrudes between said depressions, said groove comprising top-shaping and side-defining surfaces t^{10} i^{10} o^{10} and beveling-surfaces b^{10}, and said depressions comprising sole-defining surfaces s^{10} and flange-defining shoulders f^{10}. The eleventh, being the last pass, converts the cobble into the finished product, Fig. 2^z. This pass, Figs. 2 and 6, is formed by a deep groove in the bottom roll A^2 and a shaping-collar on the middle roll B^2, said groove comprising a top-finishing surface t^{11}, side-finishing surfaces i^{11} o^{11}, bevel-finishing surfaces b^{11}, and flange-defining shoulders f^{11}, and said shaping-collar comprising a recess-finishing projection r^{11} and sole-truing surfaces s^{11}. At all the passes the shaping-grooves are sunk wholly or in part between collars c c^2 c^3, projecting beyond the pitch lines on the respective rolls, said collars c^2 c^3, between the end collars c of the bottom and top rolls, being what are known as "beveled collars," overlapping each other at the respective pitch lines, as clearly shown in Figs. 1 and 2. Where there are no passes, shaping-collars, as r^3 r^5, &c., may be matched by idle-grooves g, Figs. 1 and 2, of any preferred shape, and shaping-grooves, as at t^4 t^6, &c., may be opposed by cylindrical surfaces a or idle-collars a^2, as preferred. The space between the flange-defining shoulders f or f^3 to f^{11}, the sole-defining and sole-truing surfaces s or s^3 to s^{11}, the beveling and bevel-finishing surfaces b or b^3 to b^{11}, and the sides of the recess-developing and recess-finishing projections r or r^3 to r^{11} within the respective shaping-grooves gradually develop and finish the beveled flanges f', Fig. 2^z, of the product, so as to perfectly shape and condense the same, as aforesaid. The spaces within the successive shaping-grooves between their side-defining and side-finishing surfaces i o or i^3 o^3 to i^{11} o^{11} and the sides of the coacting recessing developing and recess-finishing projections r or r^3 to r^{11} form the webs of the rail, which, it will be seen, are at the outset given a distinct flare that is preserved up to and including the final pass 11, as above, so that the metal in the webs can have no other set, and so that the inside of the rail as well as its soles may be and is rolled with the aid of the inter-web-shaping collars up to and including the final pass, so as to condense the metal in the webs and to render them true and perfect. The parting lines between the rolls at the first, second, fourth, sixth, eighth, and tenth passes are coincident with the bevel-forming surfaces b b^4, &c., at the third pass it is intermediate between the bevel-forming surfaces b^3 and the sole-defining surfaces s^3, and in the fifth, seventh, ninth, and eleventh passes (shown on a larger scale in Figs. 3 to 6, inclusive) the parting line is distinctly beyond the sole-defining surfaces s^5 s^7, &c. Owing to this construction of the rolls, the fins produced at the first and second passes, the fourth pass, &c., are worked in or obliterated at the next succeeding pass before they lose their heat to any considerable extent, and the rail-flanges in the cobble are thus kept solid and homogeneous, so that the said flanges f' in the final product, Fig. 2^z, and particularly their bevels, are clean and sharp, as well as of the greatest possible strength and rigidity. In passing from the first pass to the second pass the nearly solid cobble is inverted with facility. It then maintains its inverted position throughout all the passes, whereby handling the cobble is greatly facilitated, and the danger of accidents thereto materially lessened.

In the modification represented by Fig. 7 the cobble is rolled sidewise instead of vertically at the first two passes, marked, respectively, $1^\times$ $2^\times$, and the recessing projections r r^2,

Fig. 1, are consequently omitted from these passes. The modified passes are formed by a deep shaping-groove in the middle roll B′, a shallower matching-groove in the bottom roll A′, and a still shallower groove in the top roll C′, comprising in common sole-defining shoulders s^a s^b s^c, flange-defining surfaces f^a f^b f^c, and beveling-surfaces b^a b^b b^c, together with inner and outer side-defining surfaces i^a w o^c, of which said surface w, being part of the bottom of the groove in the middle roll, defines the inner side at the first pass and the outer side at the second pass, as the cobble is not turned in passing from the first pass to the second pass in this arrangement. A quarter-turn instead, effected in dropping to or at the third pass, brings the cobble into its said inverted position, maintained throughout the remaining passes. The latter may be of the form and arrangement above described.

Other like modifications in the details of the rolls will suggest themselves to those skilled in the art.

Figs. 8 and 9 represent, respectively, a box-rail having a high guard g' at the inner edge of its top, designed for curves, and one of several additional sections of box-rail that have been already designed for use as optional substitutes for the product of the rolls, as represented by Fig. 2^z, from which they differ mainly in the shape of the top or tread portion t', Fig. 9. Rolls for these or any analogous box-rails may be constructed on the principle above set forth and in substantially the particular manner specified.

Details which have not been specified may be of any approved description, and we do not limit our respective claims to mechanical details, nor to details of shape and proportions, except as therein stated.

We do not claim, broadly, beginning at or about the first pass to give the final shape to a railway-rail in a rolling-mill, nor rolling such rails in one position from at or about the second or third pass, so as to obviate turning the cobble. In these respects we follow approved plans of roll construction that are old and well known; but in constructing rolls for box-rails on these principles we have overcome difficulties which do not ordinarily present themselves, and in beginning at or about the first or third pass to shape the beveled clamping-flanges of the particular box-rails hereinbefore described such flanges are not only perfectly shaped, but are condensed and hardened, as aforesaid, so as to render them peculiarly well-adapted to resist the breaking strains to which they are subjected when the rails are in use.

Having thus described the said rolls, we claim as our invention and desire to patent under this specification—

1. Girder-rail rolls for rolling box-rails with beveled flanges, such rolls being constructed with suitable first and second passes, and at their third pass with sole-defining surfaces s^3, flange-defining shoulders f^3, and beveling-surfaces b^3 in duplicate, and a recessing projection r^3, and with successive sole-defining or sole-truing surfaces, flange-defining shoulders, beveling or bevel-finishing surfaces, and recess-developing or recess-finishing projections at all succeeding passes, substantially as shown and described.

2. Girder-rail rolls constructed with suitable first and second passes, and at their third pass with flaring inner and outer side-defining surfaces i^3 o^3, and a recessing projection r^3, having beveled sides opposed to said surfaces, and with flaring side-defining or side-finishing surfaces and recess-developing or recess-finishing projections at all succeeding passes, substantially as shown and described, whereby a box-rail is rolled with normally-flaring elastic webs, in the manner set forth.

3. Girder-rail rolls constructed with suitable first and second passes, and at their third pass with sole-defining surfaces s^3, flange-defining shoulders f^3, and beveling-surfaces b^3 in duplicate, and with successive sole-defining or sole-truing surfaces, flange-defining shoulders, and beveling or bevel-finishing surfaces at all succeeding passes, their parting lines being coincident with said beveling or bevel-finishing surfaces at some of the passes and beyond the sole-defining or sole-truing surfaces at alternate passes, substantially as shown and described, for the purpose set forth.

4. Box girder-rail rolls constructed with suitable first and second passes, and with their third and succeeding passes all conformed to the cobble and final product in inverted position, substantially as shown and described, for the purpose set forth.

5. A three-high train of box girder-rail rolls having their first and second passes in one and the same vertical plane and succeeding passes between the bottom and middle rolls and between the middle and top rolls alternately, and constructed with sole-defining surfaces s, flange-defining shoulders f, beveling-surfaces b, flaring side-defining surfaces i o, a top-defining surface t, and a recessing projection r at their first pass, and with successive sole-defining or sole-truing surfaces, flange-defining shoulders, beveling or bevel-finishing surfaces, flaring side-defining or side-finishing surfaces, top-defining, top-shaping, or top-finishing surfaces, and recess-developing or recess-finishing projections at all succeeding passes, substantially as shown and described, for the production of box-rails with beveled flanges on normally-flaring elastic webs in the manner and for the purposes set forth.

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