

May 23, 1933.

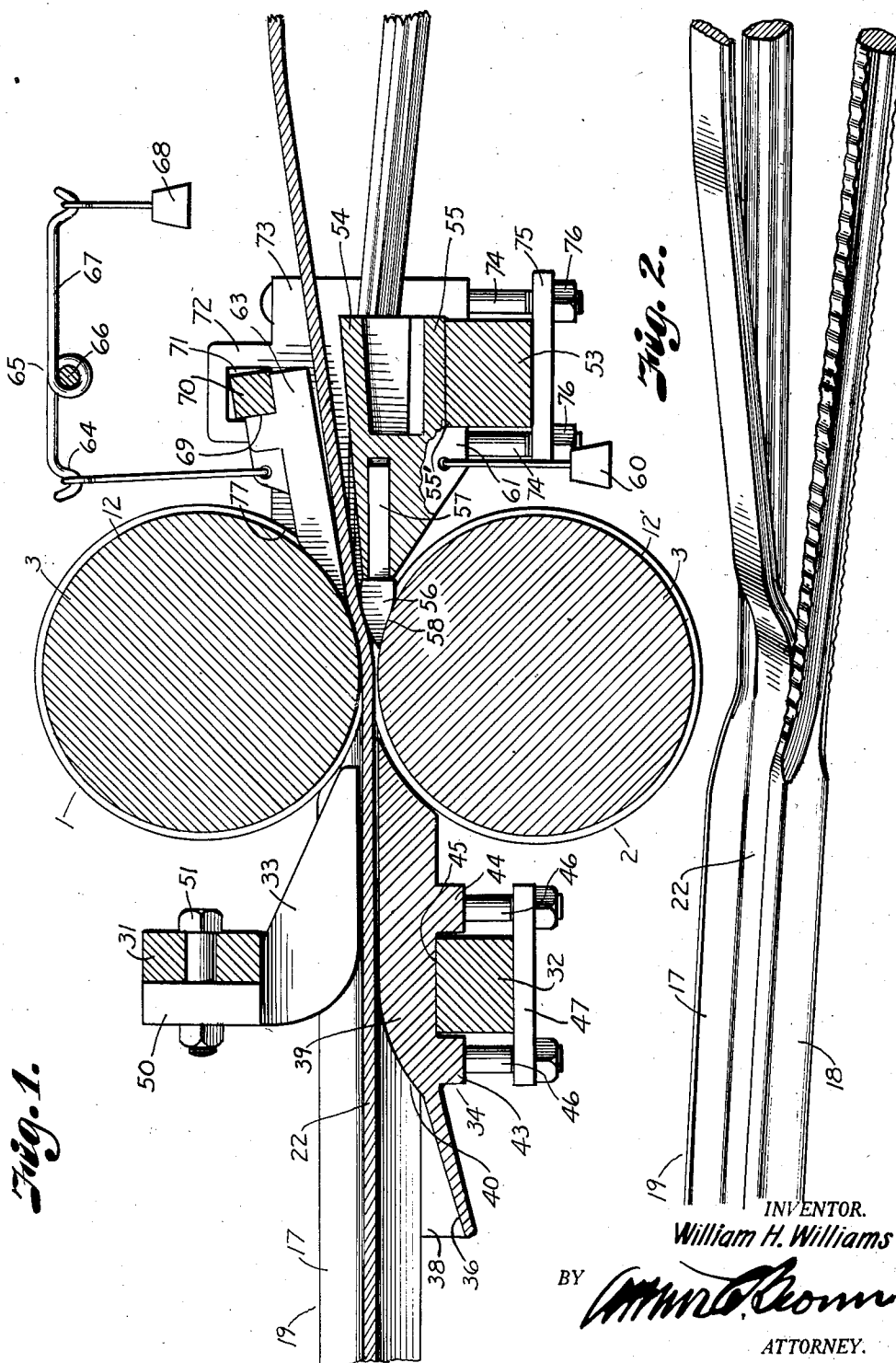
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PROCESS AND APPARATUS FOR REROLLING RAILROAD RAILS

Filed Dec. 16, 1931

3 Sheets-Sheet 1



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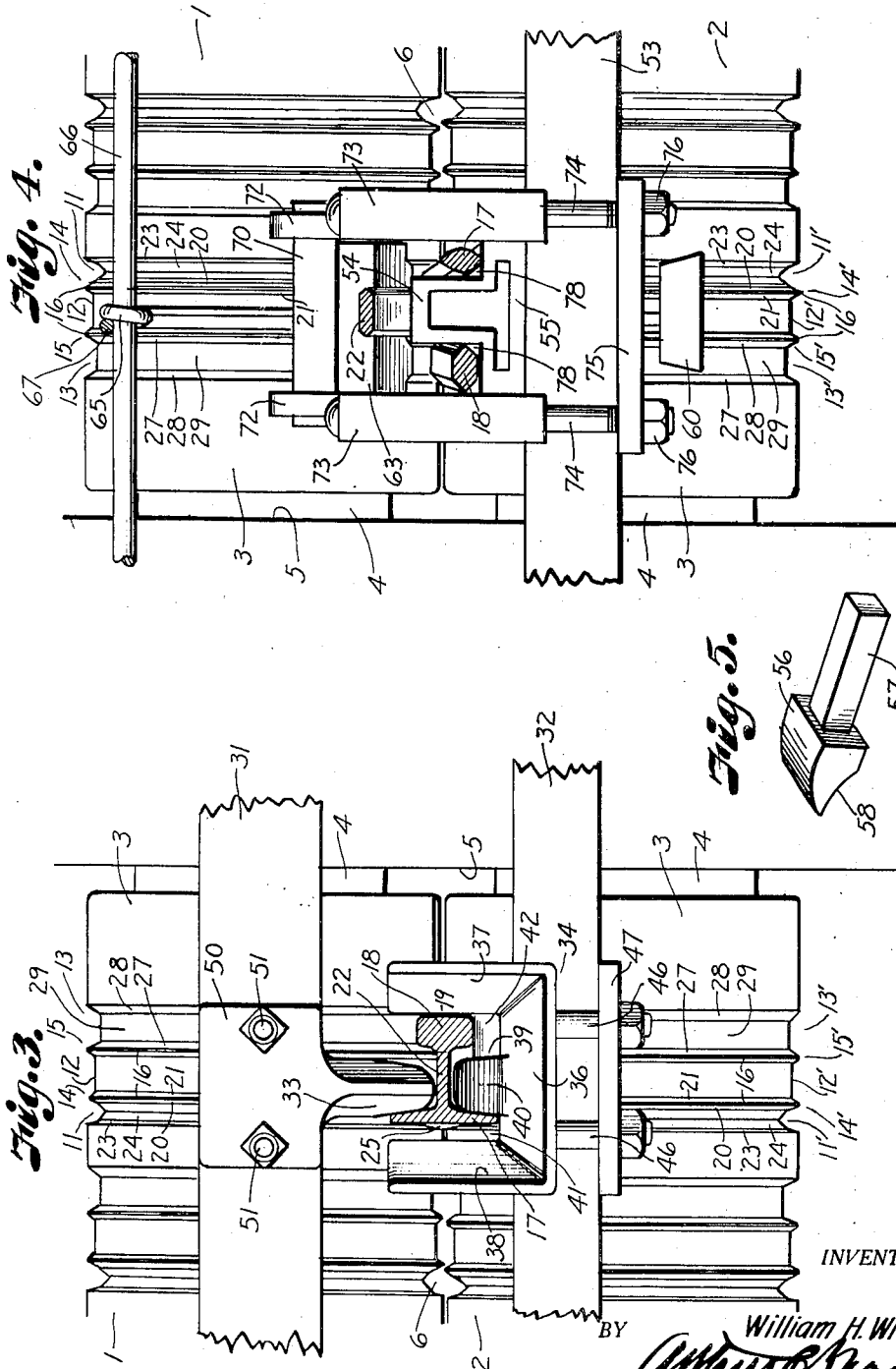
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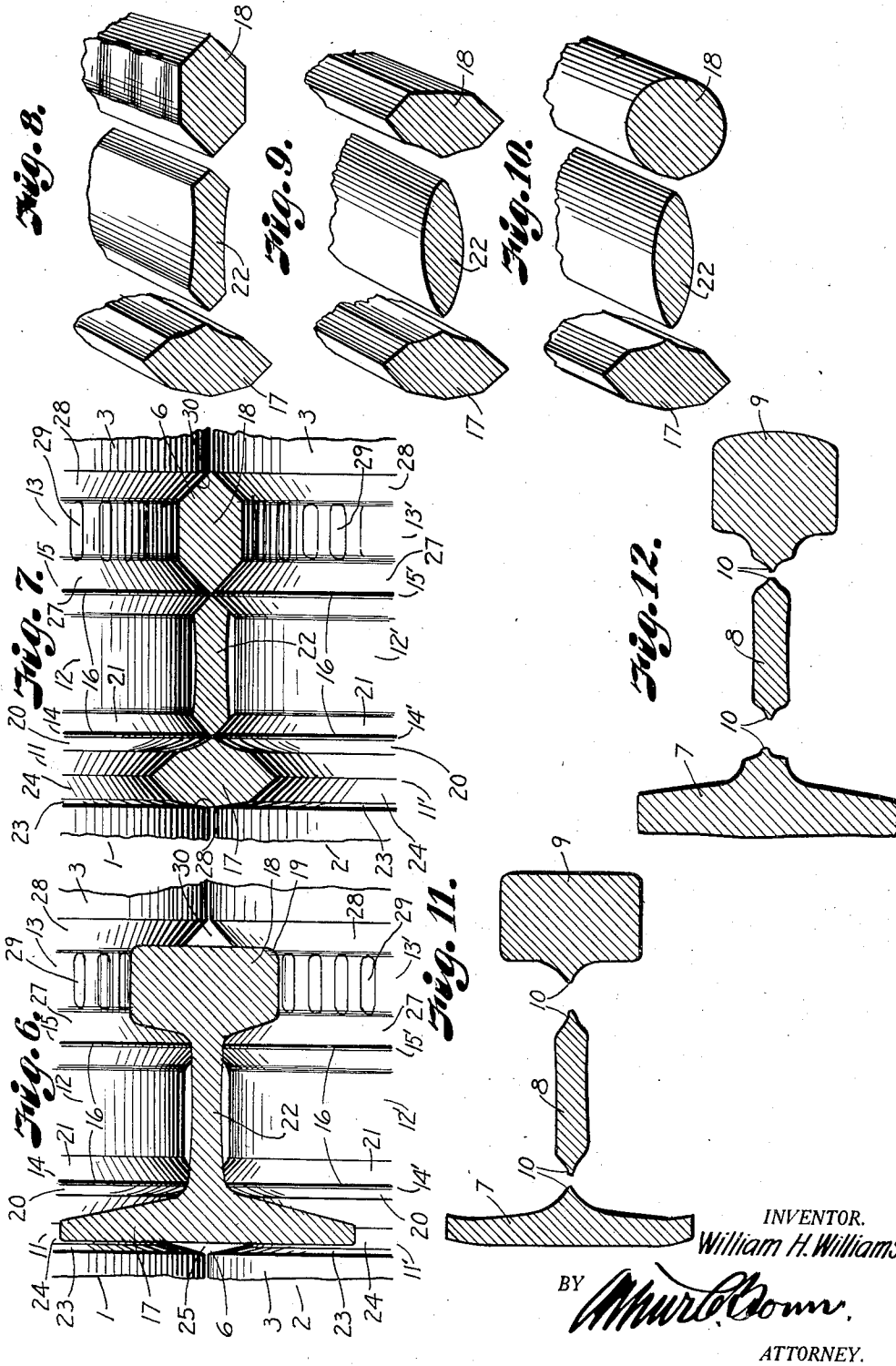
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PROCESS AND APPARATUS FOR REROLLING RAILROAD RAILS

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UNITED STATES PATENT OFFICE

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PROCESS AND APPARATUS FOR REROLLING RAILROAD RAILS

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This invention relates to a process and apparatus for re-rolling railroad rails and other similar shapes into a plurality of smaller products, and has for its principal objects to dissect the head, web and base of the rails and simultaneously reduce them in cross section into shapes that permit their rapid reduction to the desired product in subsequent rolling operations, thereby effecting a saving in mill power and providing a finished product of superior quality, free from laps and other surface defects which are common in re-rolled metal.

In accomplishing these and other objects of the invention, I employ an improved apparatus for effecting my process which is illustrated in the accompanying drawings, wherein:

Fig. 1 is a vertical cross sectional view through a stand of slitting rolls, showing the passage of a railroad rail, the section through the stand being taken at the pass for the web of the rail, and particularly illustrates the entry and delivery guide constructions at the respective sides of the rolls.

Fig. 2 is a detail perspective view of a railroad rail wherein the head, web and base are partly dissected and illustrating their relative relation after passing through the slitting rolls.

Fig. 3 is a fragmentary elevational view of one end of the stand of rolls at the entry side, particularly illustrating the guide for positioning the rail relative to the rail pass.

Fig. 4 is a similar view at the delivery side of the rolls illustrating the method of guiding the dissected rail sections.

Fig. 5 is a detail perspective view of the web deflecting member.

Fig. 6 is an enlarged cross sectional view through a rail illustrating its position and size relative to the pass between the rolls.

Fig. 7 is a similar sectional view through the rail directly in the vertical center line of the pass, illustrating its degree of reduction.

Fig. 8 is an enlarged fragmentary view of the rail sections resulting from the passes illustrated in Figs. 6 and 7, wherein the base of the rail is formed in a vertical diamond, and the web and head in horizontal diamonds.

Fig. 9 is a similar view of rail sections resulting from a modified form of pass wherein the base and head sections of the rail are formed in vertical diamonds and the web in a horizontal oval.

Fig. 10 is a similar view of rail sections resulting from a further modified form of pass wherein the head of the rail assumes a circular cross section.

Figs. 11 and 12 are cross sectional views through rail sections resulting in present slitting processes.

Referring more in detail to the drawings:—

1 and 2 designate respectively the top and bottom rolls of a stand for the slitting of railroad rails wherein each roll includes a cylindrical body portion 3 having necks 4 that are rotatably mounted in end frame members 5, as in standard rolling mill design. The rolls are rotated by suitable wobbler connection with a power (not shown), and which forms no part of the present invention.

The rolls 1 and 2 are provided with a series of rail passes 6, there being a series of passes so that when the first pass becomes worn, the rolls and guides may be adjusted to use the succeeding passes after which the rolls may be re-machined as in ordinary practice.

In the early conversion of old rails, they were first dissected by passing them through a stand of slitting rolls and no reduction in their area was attempted, since the slitting operation was so difficult that rolling mill operators were satisfied by the mere slitting of the rails. Thus the head, web and base of the rails retained their previous shape, which shapes are not considered standard in rolling mill practice, as they do not permit of rapid reduction when the rail sections are passed through subsequent stands of rolls to draw the sections into the desired products. Consequently, it was necessary to run the severed rail sections through one or more intermediate roughing passes to convert them into standard rolling sections that were capable of rapid reduction when run through the finishing passes. This resulted in loss of heat due to the extra time consumed in the roughing steps, and the sections were often worked at too low a temperature in the final passes,

resulting in a poor product and requiring a great amount of power to run the mill. Difficulty was also experienced because the rails failed to slit close enough to the head and base, and a rib-like projection was left along the rail sections having a fin or flash that in the subsequent rolling steps was very apt to bend over and form a "lap".

Difficulty was also encountered because the rail sections failed to split at the ends of the rails since velocity of the rail was depended upon to carry the end of the rail over the portion of the delivery guide that tore the sections apart.

It has long been apparent that reduction of the rail sections in the slitting rolls was highly desirable due to the extreme reduction required to convert the rail sections into their final shapes. When such reduction was attempted the slitters failed to operate, but this difficulty was partly overcome by changes in the guides, and a slight reduction in the vertical thickness of the rail sections was effected as shown in Figs. 11 and 12. However, no change in the shape of the sections has been accomplished in a sidewise direction as is necessary to eliminate the roughing passes.

It will be noted in Fig. 11 that only the base 7 of the rail has been reduced in a vertical direction, while the web 8 and head 9 have retained substantially the same cross section as the original rail, and that undesirable fins 10 are produced in the slitting process.

In Fig. 12, both the head and base sections have been reduced in a vertical direction and a slight upset has been obtained in sidewise directions, but neither the base nor head sections are formed in the shapes considered standard for rapid reductions. It will also be noted that the slitters did not cut close to the head and base sections, thereby leaving ribs also having flash or fins 10 similar to the sections illustrated in Fig. 11.

It is also difficult to guide the rails so that they will enter the pass in the right position and place.

As above pointed out, I have provided improved entry and delivery guides and so shaped the passes that I have been successful in simultaneously slitting the rails and reducing the rail sections to standard shapes that permit rapid reduction, as illustrated in Figs. 8 to 10, later described.

The passes 6 are formed by peripheral grooves 11, 12 and 13 in the roll 1 matching similar grooves 11', 12' and 13' in the roll 2, and the grooves in each roll are separated by slitting collars 14 and 15 for the roll 1 and 14' and 15' for the roll 2. The slitting collars comprise substantially triangular-shaped annular ribs formed integrally with the rolls and are provided with substantially blunt cutting edges 16 spaced apart a suitable distance to cut close against the base 17

and head 18 of the rail 19, as illustrated in Figs. 6 and 7.

The complementary cutting edges are spaced apart to allow for expansion of the rolls when they become heated by the hot metal passing therebetween, and for this reason the cutters fail to cut entirely through the metal. To offset this failure, the side faces 20 and 21 of the respective slitting collars are formed at an angle to produce a wedging action when the blunt edges thereof press into the metal and tend to push the sections apart to exert internal tension sufficient to tear the incompletely severed portion of the web, as illustrated in Fig. 7.

The intermediate grooves 12 and 12' form the portion of the pass for the web 22 of the rail and are preferably of a combined depth greater than the thickness of the web in order that no compression forces act in a vertical direction as the web is passed between the rolls. However, the web 22 is compressed slightly in a sidewise direction due to the inclined faces of the cutting collars acting against the side edges of the web, effecting a slight upset of the metal. Thus it is apparent that very little or no elongation is produced in the web and that the web will travel through its pass at substantially the peripheral speed of the slitting rolls. This is an important feature of the invention as the relative speeds between the web and the head and base sections cooperate to assure positive severance of the sections, as later described.

The grooves 11 and 11', forming the pass for the base of the rail, include the inclined faces 20 of the slitting collars 14 and 14', which may be slightly curved as shown, and an inwardly inclined face 23 terminating in V-shaped bottoms 24 to form a pass of substantially diamond shape and having an effective area that may be as small as thirty-three and one-third per cent ($33\frac{1}{3}\%$) of the area of the base section, whereby the elongation of the extruded base section is approximately fifty per cent (50%) greater than the length of the rail entering the pass. Thus the rail section will be extruded at a substantially greater speed than the peripheral speed of the rolls and linear speed of the web section. This difference in speed aids materially in completing clean severance of the base and web sections.

By observing Figs. 6 and 7, it will be noted that a substantial amount of metal in the base flange is extruded laterally to fill the V-shaped portion 25 of the groove projecting beyond the bottom face of the rail.

The grooves 13 and 13', forming the pass for the head section of the rail, have inwardly extending inclined side faces 27 and 28 and flat bottoms 29 so that the resulting pass between the rolls is substantially diamond shaped and may be approximately

thirty three and one-third per cent ($33\frac{1}{3}\%$) of the area of the head portion of the rail. The major width of the pass is preferably wider than the thickness of the head of the rail similar to the base pass previously described. Thus part of the rail head is extruded laterally to fill that portion of the pass, as illustrated at 30 in Fig. 7. It is, therefore, apparent that the metal in both the base flange and head is reduced in a vertical direction and simultaneously spread in a lateral direction, whereby the metal is worked in both directions to accomplish the extreme reduction and elongation of the rail sections as they are drawn through their respective portions of the pass.

The inclined walls of the grooves 11 and 13 also produce a wedging action to draw the head and flange sections outwardly, thereby cooperating with the inclined faces on the opposite sides of the slitting collars to sever the sections.

In rolling practice it has been assumed that great care must be employed to see that the metal flows evenly and that all sections in contact with the roll flow with the same speed of the roll in the deformation process. It has also been considered that the angle of contact should not be greater than 30° in order that the bars will successfully enter between the rolls, but I have found that an angle of about 37° may be used by ragging the bottom of the grooves 13 and 13' which deform the head section of the rail. It is necessary that the rails may be properly guided relatively to the passes between the rolls and I have provided an improved entry guide, as best illustrated in Figs. 1 and 3, as now described.

Extending across the front face of the rolls and supported by the frame members are spaced rest bars 31 and 32, positioned respectively above and below the horizontal plane of the pass for supporting top and bottom entry guides 33 and 34, respectively. The guide element 34 is of substantially trough shape and supports the rail in horizontal position in alignment with the pass between the rolls, and includes an upwardly inclined floor portion 36 and inwardly inclined side walls 37 and 38. Projecting upwardly from the floor portion 36 is a boss or rib 39 having a curved forward end 40 to raise the end of the rail into alignment with the pass. The rib 39 is spaced from the walls 37 and 38 to form spaced guideways 41 and 42 for the base flange and head of the rail, respectively.

By observing Fig. 1, it will be noted that the upper face of the rib 39 barely clears the lower face of the web and that its side face adjacent the lower face of the base flange presses tightly thereagainst, so that the rail has little or no lateral movement in its passage through the entry guide.

Formed on the bottom of the guide are spaced ribs 43 and 44 forming a recess 45 for admitting the upper edge of the rest 32 on which the guide element is supported and is secured thereto by bolts 46 extending through a keeper plate 47 extending across the bottom of the rest. The guide element is thus adjustably mounted on the rest but is retained after adjustment by the ribs 43 and 44 and the clamping plate 47. In order to hold the rail down against the bottom entry guide, I provide the upper entry guide 33 which engages between the head and base flange of the rail. The bottom and left side face of the guide bear against the upper face of the web and the inner upper face of the rail flange, respectively. The guide is supported by a lug 50 bolted to the upper rest bar 31, as illustrated in Figs. 1 and 3, the bolts 51 passing through suitable openings in the rest bar 31 and lug 50.

The entry guides are thus located to bear against the inner faces of the base flange and support the rail in alignment with the slitting collars previously described, so that the slitting collars operate close to the base and head of the rail to prevent formation of the ribs illustrated in Fig. 12.

The guides at the delivery side of the rolls are supported on a rest bar 53 carried by the end frames 5 and extending longitudinally of the rolls at a point below the rail pass.

The lower guide 54 comprises a casting 55 having a notched shoulder portion 55' resting on and against the rest bar 53 and which has a triangular-shaped end extending rearwardly between the rolls 1 and 2 but terminating short thereof to accommodate a web deflecting head 56 now described. Formed in the rearwardly projecting portion of the guide is a rectangular-shape socket for mounting the shank 57 carrying the head 56. The lower face of the head is provided with an arcuate face 58 which rides on the bottom of the groove 12' to support the forward end of the pivoted guide. The upper face of the head curves upwardly above the horizontal plane of the pass to force the web abruptly in an upward direction immediately after emerging from the slitting collars. The lower guide is supported in position by a weight 60 depending from an ear 61 formed on the lower face thereof at a point rearwardly of the rest 53.

The end of the web, on being deflected upwardly, is again deflected into a substantially horizontal direction by the floating guide 63 that is suspendingly supported from the end 64 of a lever 65, the lever 65 being pivoted on a rod 66 supported by the side frames 5. The lever 65 includes an oppositely projecting arm 67 which carries a balancing weight 68 to balance and stabilize the guide. The rear end of the guide is provided with a notch-shaped seat 69 for engaging a bar 70 that may

be wedged or similarly secured in openings 71 formed in ears 72 projecting upwardly from side guide plates 73 later described. The forward end of the guide 63 bears in the bottom of the groove 12 in the upper roll and, since the other end bears against the bar 70, it is firmly retained in position to deflect the web as shown in Fig. 1.

The guide plates 73 are supported by the rest 53 on opposite sides of the lower guide 54 and are secured in position by the bolts 74 that extend through sockets in the sides of the guides and through a clamping bar 75 extending under the rest, nuts 76 being threaded on the ends of the bolts and engaging the clamping bar as shown in Figs. 1 and 4.

The ends of the side plates are also provided with arcuate faces 77 to extend within the angles formed between the rolls in order that the head and base flange of the rail sections may be guided in outwardly inclined directions immediately upon their ejection from between the rolls.

The guide plates cooperate with shoulder portions 78 in the sides of the member 54 to form grooves for guiding and spreading the head and base sections apart and to assist in the severance from the web sections.

From observing Fig. 1, it is apparent that a decided bend is effected in the web after it has passed from between the rolls to aid in tearing sections apart and particularly the final ends of the sections after they have been released from between the rolls.

In practicing my process the rails are heated to the proper temperature as in standard rolling mill practice. They are then delivered one after the other at intervals by a suitable conveyor (not shown) so that the ends of the rails enter between the upper and lower entry guides which bear against the inner faces of the base flange and confine the web in position to enter the pass in the proper place. As soon as the end of a rail engages the roll, the ragging bites into the rail to draw it through the pass. The slitting collars act on the rail along junctures of the head and base flange with the web.

Immediately upon ejection of the ends of the rail from the pass the web section is deflected upwardly by the head 56 and again forwardly by the top delivery guide at a slight incline to aid in tearing the sections apart. Due to the area and shape of the pass the head and base portions of the rail are reduced in size and shaped as shown in Fig. 8. This extreme reduction causes these sections to be extruded at a greater velocity than the speed of the incoming rail, but the web as above pointed out is delivered at substantially the speed of the rolls. This difference in speed is very important as it aids in the complete severance of the sections and at the same time tends to smooth off the flash or fin tending to form by the slitting

operation, the fin being drawn longitudinally into the metal sections extruded through the pass. After the sections have been delivered through the delivery guides they are in condition to be delivered through the first of the finishing passes necessary to reduce the sections to the desired products. Thus it is apparent that the usual roughing passes are eliminated and the sections may be rolled to the finished products while they are at the proper heat. Also by eliminating fins or flash, the finished product is free from laps and other surface defects.

What I claim and desire to secure by Letters Patent is:

1. The process of re-rolling metal including slitting the metal into strips, reducing the strips to standard rolling mill sections at the time and place of the slitting, and separating the formed sections from contact with each other simultaneously with the slitting.

2. The process of re-rolling metal including heating the metal, slitting the heated metal into strips, forming the strips into standard rolling mill sections having substantially diamond shape cross section at the time and place of the slitting, and separating the formed sections from contact with each other.

3. The process of re-rolling metal including heating the metal, slitting the heated metal into strips, elongating one of the strips at the time and place of the slitting to aid in its separation from its adjacent strip, and spreading the metal of said strip simultaneously with the elongation.

4. The process of progressively re-rolling metal including heating the metal, slitting the metal into strips, elongating one of the strips at the time and place of the slitting, and bending its adjacent strip upwardly and then forwardly in the direction of movement of the strips to aid in the slitting.

5. The process of progressively re-rolling metal including heating the metal, slitting the metal into strips, elongating and simultaneously spreading the metal in one of the strips at the time and place of the slitting, and bending its adjacent strip upwardly and then forwardly in the direction of movement of the strips to aid in the slitting.

6. The process of re-rolling railroad rails including dissecting the head, web and base flange of a rail, simultaneously elongating and forming the head and base flange into standard rolling mill sections at the place of the dissecting, and bending the web upwardly and then forwardly relatively to the formed sections to aid in the dissecting.

7. The process of re-rolling railroad rails including dissecting the head, web and base flange of a rail, applying pressure to only the head and base flange portions to produce elongation thereof beyond the length

of said web portion, and deflecting the web portion of the rail at a point after the dissecting to aid in the separation of head and base flange portions from said web portion.

8. In an apparatus for re-rolling rails including a stand of rolls having matched grooves forming substantially diamond shaped passes to reduce the head and base flange of a rail passed therethrough into sections having diamond shaped cross section, slitting collars on the rolls for dissecting said head and base flange simultaneously with their reduction, and means supported adjacent said rolls to effect separation of said shaped sections from contact with the web of the rail.

9. In an apparatus for re-rolling metal including means for progressively slitting the metal into strips, means for elongating one of the strips at the time and place of the slitting, and means for deflecting the other strip upwardly from the plane of said elongated strip to aid in the slitting of said strips.

10. In an apparatus for re-rolling metal including a stand of rolls having matched grooves forming substantially diamond shaped passes to reduce the metal into sections having diamond shaped cross section, slitting collars on the rolls for dissecting said sections simultaneously with their reduction, and means for deflecting one of the sections upwardly from the plane of the adjacent section to aid in the dissecting.

11. In an apparatus for re-rolling rails including a pair of rolls having matched aligning grooves forming passes for the head, web and flange of a rail to shape the head and flange to standard rolling mill sections when delivered through the rolls, means on the rolls for severing the head and flange from the web of the rail, and means for deflecting the web upon passage through said rolls to cooperate with the severing means to sever said sections from the web.

12. In an apparatus for re-rolling rails including a stand of rolls having matched aligning grooves forming passes for reducing and shaping the head and base flange of a rail into definite shaped cross sections, means pressing on the base flange and web of the rail to guide the rail through said passes, slitting collars on said rolls to dissect the head and base flange from the web of the rail, and means associated with the rolls to separate said dissecting members.

In testimony whereof I affix my signature.

WILLIAM H. WILLIAMS.