J. E. YORK.

PROCESS FOR REROLLING RAILS.

APPLICATION FILED JUNE 16, 1903.

1,001,115.

Patented Aug. 22, 1911.

3 SHEETS—SHEET 1.

FIG. 1.

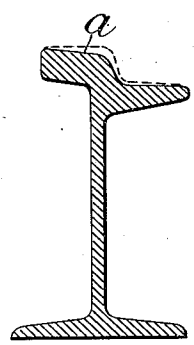


FIG. 2.

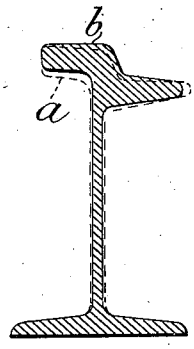


FIG. 3.

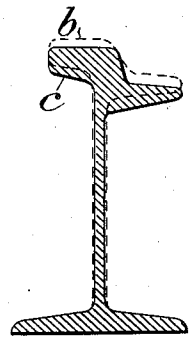


FIG. 4.

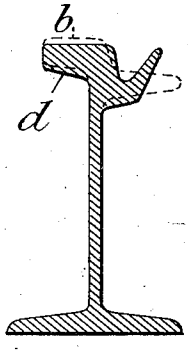
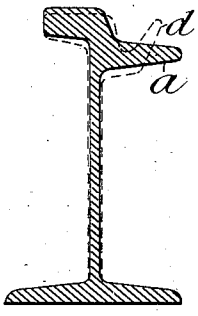


FIG. 5.



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3 SHEETS—SHEET 2.

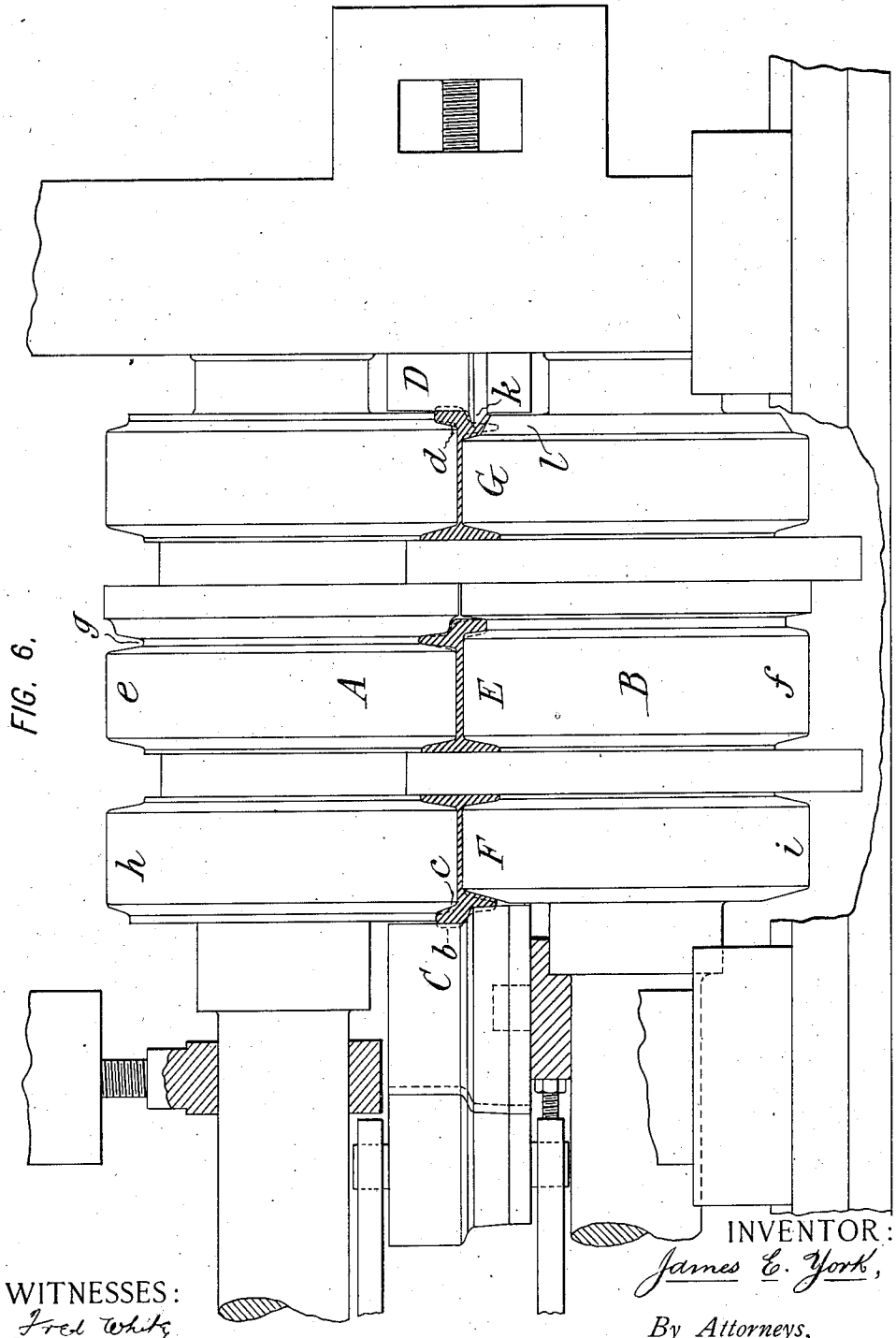

FIG. 6.

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3 SHEETS—SHEET 3.

FIG. 7.

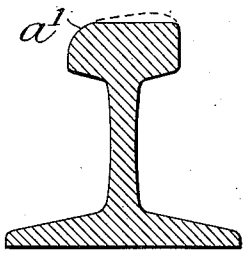


FIG. 8.

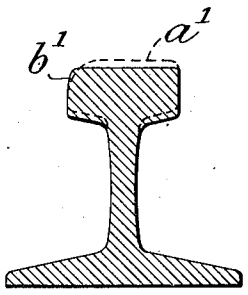


FIG. 9.

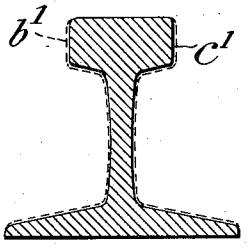
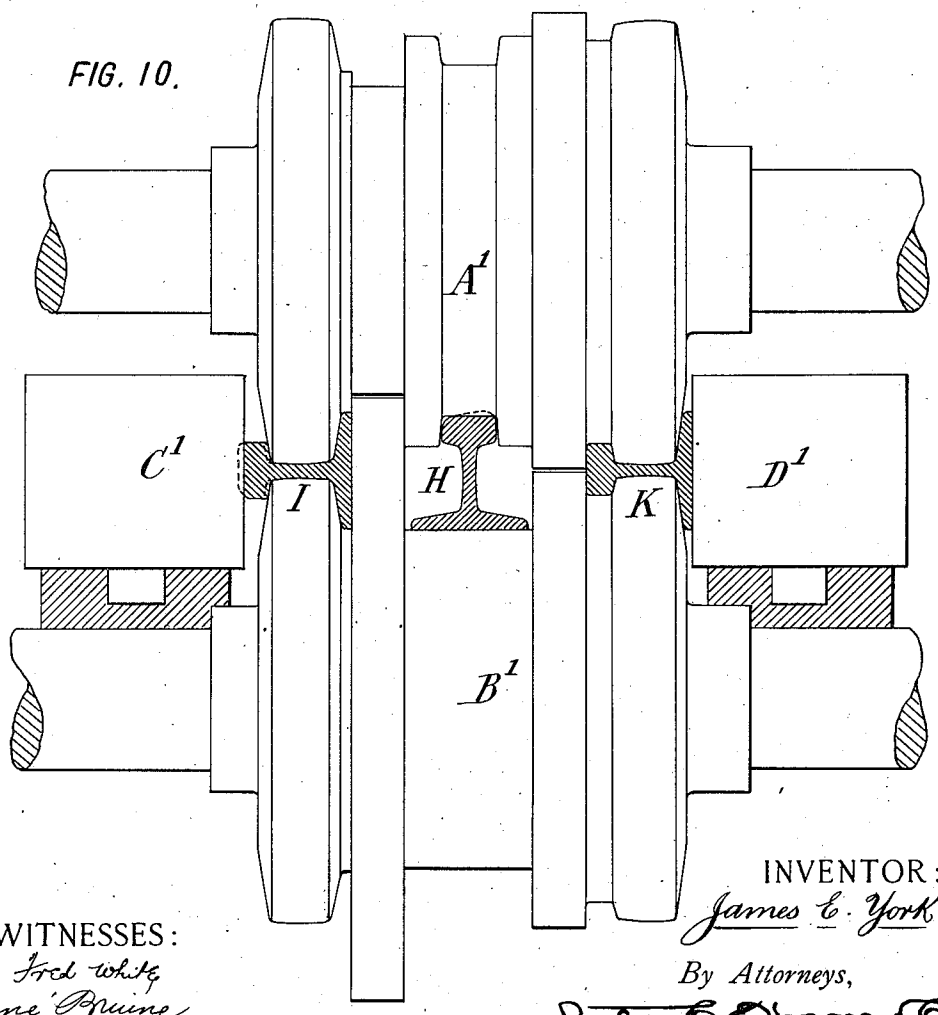


FIG. 10.



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UNITED STATES PATENT OFFICE.

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PROCESS FOR REROLLING RAILS.

1,001,115. Specification of Letters Patent. Patented Aug. 22, 1911.

Application filed June 16, 1903. Serial No. 161,661.

To all whom it may concern:

Be it known that I, JAMES E. YORK, a citizen of the United States, residing in the borough of Brooklyn, county of Kings, city and State of New York, have invented certain new and useful Improvements in Processes for Rerolling Rails, of which the following is a specification.

This invention provides a new method of re-rolling worn railway rails, particularly girder rails such as are used principally on electric railways.

As only the top of the rail has been changed in outline, by wear and distortion, it is desirable to make as little change as possible in the section of the rail elsewhere. To restore to the head an amount of metal partly replacing that worn off, enough to make the desired standard section, it is necessary to take this amount of metal from other portions of the cross-section. The re-rolling of T-rails has been attempted by reducing the section in all portions of the rail alike, thereby reducing the rail by re-rolling to one of a smaller size and less weight per lineal unit. In ordinary processes both of original rolling and re-rolling, the rail is subjected to internal strains by reason of the varying surface speeds at which different portions of the rolls travel, whereby the metal of the web for instance is urged forward at a faster rate than the sides of the head or flange; and these internal strains weaken the rail and tend to cause breakages in service.

According to my invention I pass the worn rail between rolls which widen the web by lifting the head or forcing it away from the flange, and taking out a portion of the taper on the under side of the head, but without making any change in the flange except possibly if desired to reduce its taper. The practical result of this pass through the rolls is to make a rail with slightly thinner and somewhat wider web, but with head and flange practically unchanged. Then by another pass through the same or other rolls, I upset metal from the web into the head by exerting pressure against the head to force it toward the flange while the web is tightly gripped between opposite rolls. The upsetting pressure is applied by means of a third roll (called a side roll) with its axis perpendicular to the main rolls, and which acts against the top of the rail. This side roll has a contour corresponding to that of the top of the rail, and acts (either during the second pass, or a third pass if preferred) to roll down the top or wearing surface of the rail to the desired contour. The pressure of this third roll upon the rail is exerted in the same direction as the pressure which it will receive in actual use, and it has the effect of compacting and fining the grain of the wearing surface of the rail and thereby making it dense, hard and durable. The rail is given the maximum durability by accomplishing the re-rolling at a low red heat, instead of rolling at the high temperature at which rails are commonly rolled.

I will proceed to describe my invention more in detail with reference to the accompanying drawings, wherein,

Figures 1, 2 and 3 are sections of a girder rail showing successive stages of the operation; Figs. 4 and 5 are sections of other forms of rails; Fig. 6 is a side elevation of the rolls used in rolling the girder rail shown in Figs. 1, 2, 3 and 4. Figs. 7, 8 and 9 are sections of a T-rail showing successive stages of re-rolling; Fig. 10 is a side elevation of the rolls used in re-rolling the rail shown in Figs. 7, 8 and 9.

The section *a* shown in Fig. 1 is that of a worn girder rail, the dotted line indicating its section as originally rolled and before being worn down. Fig. 2 shows in full lines *b* the result of the first pass through the rolls, the dotted lines *a* showing the previous section of the worn rail. Fig. 3 shows in full lines *c* the result of the final pass, the dotted lines *b* showing the rail as left after the first pass. Fig. 4 shows in full lines *d* a guard rail rolled from the contour *b* of Fig. 2.

Referring to Fig. 6, let A and B designate two horizontal rolls, and C and D two vertical rolls. Between these rolls are formed passes E, F and G. The pass E is adapted to convert the contour *a* of Fig. 2 into the contour *b*. The pass F is adapted to convert the contour *b* into the contour *c* of Fig. 3. The pass G is adapted to convert the contour *b* into the contour *d* of Fig. 4. In the passes F and G, the top of the rail is turned toward the outer side so that its upper surface is formed by the vertical roll or side roll C or D. These side rolls accordingly have contours conforming to the shape of the top of the rail.

The operation is as follows:—Starting with a worn rail of contour approximately that shown by outline *a* in Fig. 1, this rail, being first heated to a low heat, (preferably 800 to 900 degrees C.) is passed through the pass E. The formers *e* and *f* of the respective rolls A B are wider than the spaces between the flange and lip and the flange and head respectively of the rail section *a*, so that these formers in engaging the rail act to force out the head by wedging the head and lip away from the flange, thereby widening the web, the metal corresponding to this widening being secured by reducing the taper under the head and lip. (See Fig. 2.) The formers *e* and *f* are made with their sides more abrupt than in the original contour of the rail, so that they diminish the taper beneath the head and lip. This diminution of taper may also be effected on the upper side of the lip if desired. Also preferably the groove *g* in the roll A is of less depth than the lip so that it narrows the lip somewhat, thereby forcing metal from the lip toward the head. The product of this rolling operation is shown by the outline *b* of Fig. 2. By comparing in Fig. 2 the outlines *a* and *b*, it will be seen that the head and lip have been raised and the web widened and slightly thinned, the taper beneath the head and lip having been diminished.

If it is desired to produce a re-rolled rail with a flat lip of the outline *c* in Fig. 3, the rail is then carried through the pass F. The formers *h* and *i* of the rolls A B for this pass are narrower than the formers *f* and *e* respectively of the previous pass; consequently the rail in passing through this pass has its head and lip left projecting beyond the rolls A B to the extent indicated by the dotted line *b*. By setting up the side roll C to the position shown, it acts to upset the rail and displace the head and lip against the sides of the formers *h i*. In this operation the metal of that portion of the web projecting beyond these formers is forced or displaced into the head and lip, thereby adding to the mass of the top portion of the rail sufficiently to supply the metal desired in the new section. The pressure imparted by the side roll C, rolls down the worn and uneven top surface of the rail to a regular and uniform surface of the desired contour, and compacts this surface, so that under the low heat used it becomes a hard and durable wearing surface. The upsetting of the head and rolling down of the top surface may be performed at one pass, or at two separate passes, as may be desired. To perform it at one pass, the roll C will be adjusted up close to the rolls A B, and the rail after previous rolling will if necessary be slightly tapered at its entering end so as to facilitate entering into the pass F. Or to perform these operations by two passes, the roll C will be backed off to a distance between the position shown and that indicated by the outline *b* at the left of the pass F, and the rail will then be run through, whereupon the roll C will be adjusted up to its final position, and the rail then passed back. In the pass or passes through the pass F, the web may be more or less diminished in thickness.

In case it is desired to produce from a flat-lipped girder rail, a guard rail or one having an upturned lip of for example the section *d* in Fig. 4, the rail after passing through the first pass E, or after passing through both passes E and F, is put through pass G. The side roll D has a creasing flange *k*, and the roll B has a turning flange *l* between which the lip is turned up from the position shown in dotted lines to that shown in full lines in Fig. 4. My invention is also applicable for re-rolling worn guard rails. For this purpose it is only necessary to make an appropriate change in the shape of the grooves for the first pass E. Or a preliminary pass may be given in which the upturned lip will be turned down flat as indicated by dotted lines in Fig. 4, this being done by a side roll, as by the roll C, whereupon the next pass may be through a pass of the conformation of E. At the final pass the lip may be again turned up as by the pass G in Fig. 6. Or if it is preferred to convert the guard rail into a flat-lipped or straight rail, the final pass may be as at F. This last, that is the conversion by re-rolling of a guard rail into a flat-lipped or straight rail, is indicated in Fig. 5, where the dotted lines show the worn guard rail, and the full lines the re-rolled section.

It will be understood that the rail after re-rolling is reduced to a somewhat lower weight per unit of length. Otherwise it is or may be practically unchanged in shape, and by having its top rolled to the same contour as a new rail, may be laid in the same track with new rails by making allowance for any difference in height.

My invention may be modified in the details of its application. For example in the first rolling operation through pass E, there may be the minimum of diminution in thickness of the web. If to maintain as nearly as possible the original height of the rail is not important, the web may be left as nearly as possible its full thickness, the upsetting operation taking metal from the height of the web and forcing it into the head.

While my invention is especially applicable to girder rails, it may also be applied to ordinary T-rails, or to double-head rails, or other rail sections. In such cases the process may be performed precisely as here-

inbefore described, the only difference being that the rolls may be correspondingly modified in shape to accord with the different shape of rail. In the case of T-rails, however, I find it preferable instead of first forcing up the head of the rail away from the flange, to omit this step and to first pass the worn rail between rolls which by one or more passes roll down the top of the rail to reshape its tread. I then by another pass force the head toward the flange, thereby upsetting the rail and displacing metal from the web into the head, after which by another pass the head and web are brought to their proper shape.

Figs. 7 to 10 show the preferred operations. Fig. 7 shows in dotted lines approximately the original shape of the worn rail, and in full lines a' the shape to which it is reduced by the first pass; Fig. 8 shows the result of the upsetting operation wherein the rail is reduced from the contour a' to the contour b'; after this the rail is preferably finally shaped to the desired section by a third pass, as indicated in Fig. 9, where b' is the contour resulting from the second pass and c' is that of the final section. Thus the re-rolling results in a rail of somewhat less height than its original section, with the head restored to practically its original proportions, the whole rail being reduced to a smaller section nearly conforming to its original section. Fig. 10 shows the preferred form of rolls for performing these operations. The upper and lower horizontal rolls A' B' and the side rolls C' and D', combine to form three passes H, I and K. The worn rail is first put through pass H, wherein the top roll A' acts to roll down the uneven top or tread of the rail to an even and level top. The rail is then put through pass I, wherein while its web is gripped between the horizontal rolls, the side roll C' acts to upset the rail forcing its head in as indicated in Fig. 8, thereby displacing metal from the web into the head to take the place of that which was worn off, and to provide sufficient metal to impart the new section desired. In this operation the roll C' levels the head and compacts its tread. The rail is then put through pass K, where the flange is acted upon by side roll D', which is set to reduce the thickness of the flange without diminishing its width, and by having the same surface speed as the horizontal rolls, avoids unequal internal strains in the rail. In this pass the head is narrowed and brought to the desired outline as indicated in Fig. 9, the web being rolled somewhat thinner, although preferably diminished as little as possible, and the side roll D' is set to correspondingly diminish the thickness of the flange, in order to avoid unequal strains in the metal and produce a straight rail.

It is an important advantage of my invention that the metal may be rolled at a much lower heat than that at which steel rails and girders are commonly rolled. By rolling at a low heat, or as near the critical point (700 degrees C.) as possible, the product is much harder, tougher, and more durable than when rolled at the usual high temperature. Rolling at such low heat, however, requires much heavier pressure, and imposes much greater strain upon the machinery than rolling at a high heat, and practically requires the use of chilled rolls. With ordinary rolls, where part of the reduction is effected against a projecting collar forming a closed pass, it is impracticable to chill the rolls. By my invention, however, I accomplish the effective rolling by means of the vertical or side rolls C or D, the surfaces of which, as well as the surfaces of the horizontal rolls essential to reduction of section, are easily chilled.

What I claim is:—

1. The described process of re-shaping worn rails by lifting the head and taking out a portion of the taper beneath the head so as to widen the web and to make a rail with a slightly thinner and a wider web but with head and flange practically unchanged, and re-shaping the wearing face of the head by rolling it with a pressure against said face, and simultaneously upsetting the rail to displace metal from the web into the head.

2. The described process of re-rolling worn rails by widening the web and then upsetting the rail to displace metal from the widened web into the head.

3. The described process of re-rolling worn rails by forcing up the head so as to force at least part of the metal forming the taper beneath the head into the web, thus widening the web, and then upsetting the rail to displace metal from the web into the head.

4. The described process of rerolling worn rails by widening the web, and then upsetting the rail to displace metal from the web into the head sufficiently to produce a re-rolled rail with its head practically restored to its original shape.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES E. YORK.

Witnesses:
THOMAS F. WALLACE,
FRED WHITE.