Feb. 21, 1928. 1,659,776

G. LANGFORD

METHOD OF TREATING WORN RAIL JOINTS

Filed Oct. 18, 1924 2 Sheets-Sheet 1

Fig. 2

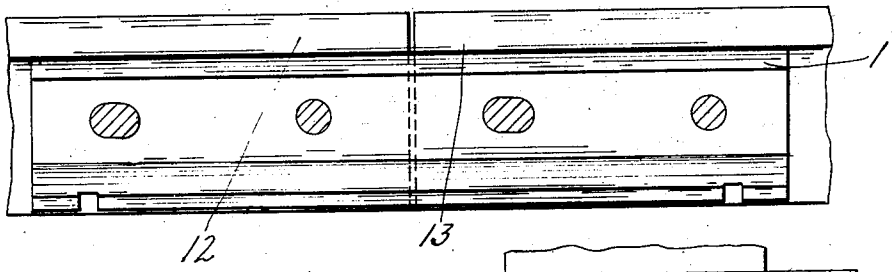


Fig. 1

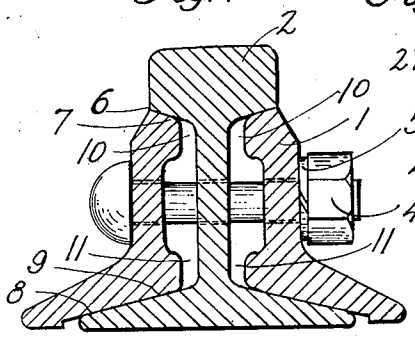


Fig. 3

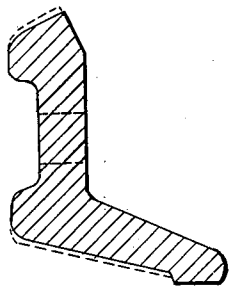


Fig. 5

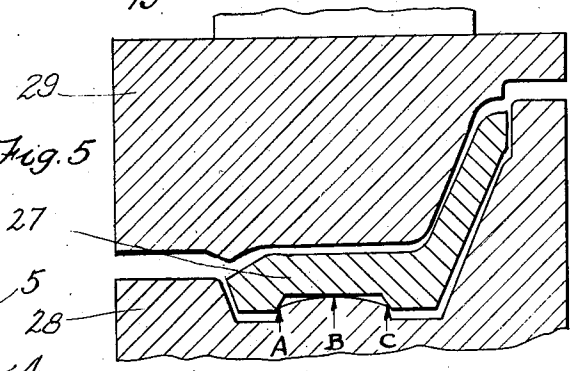


Fig. 6

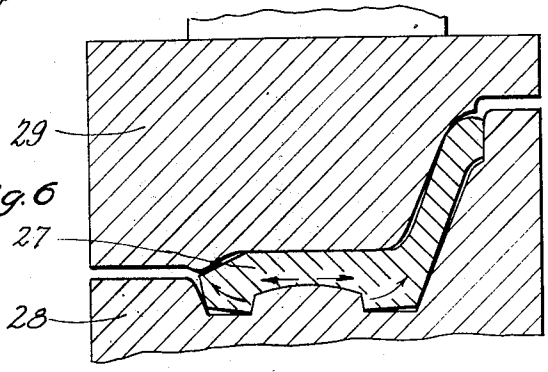
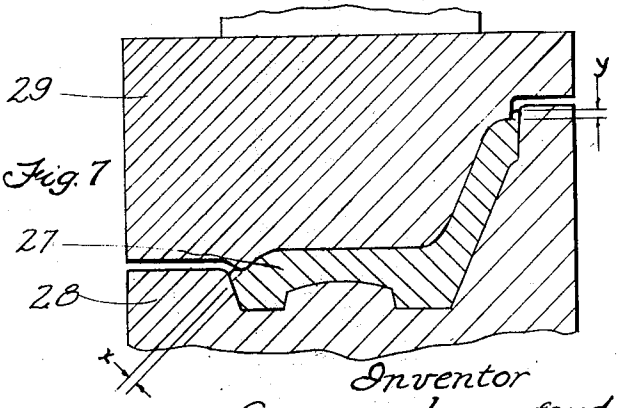


Fig. 7



Inventor
George Langford.
Brown Boulware & Dinner
Att'ys.
By

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G. LANGFORD

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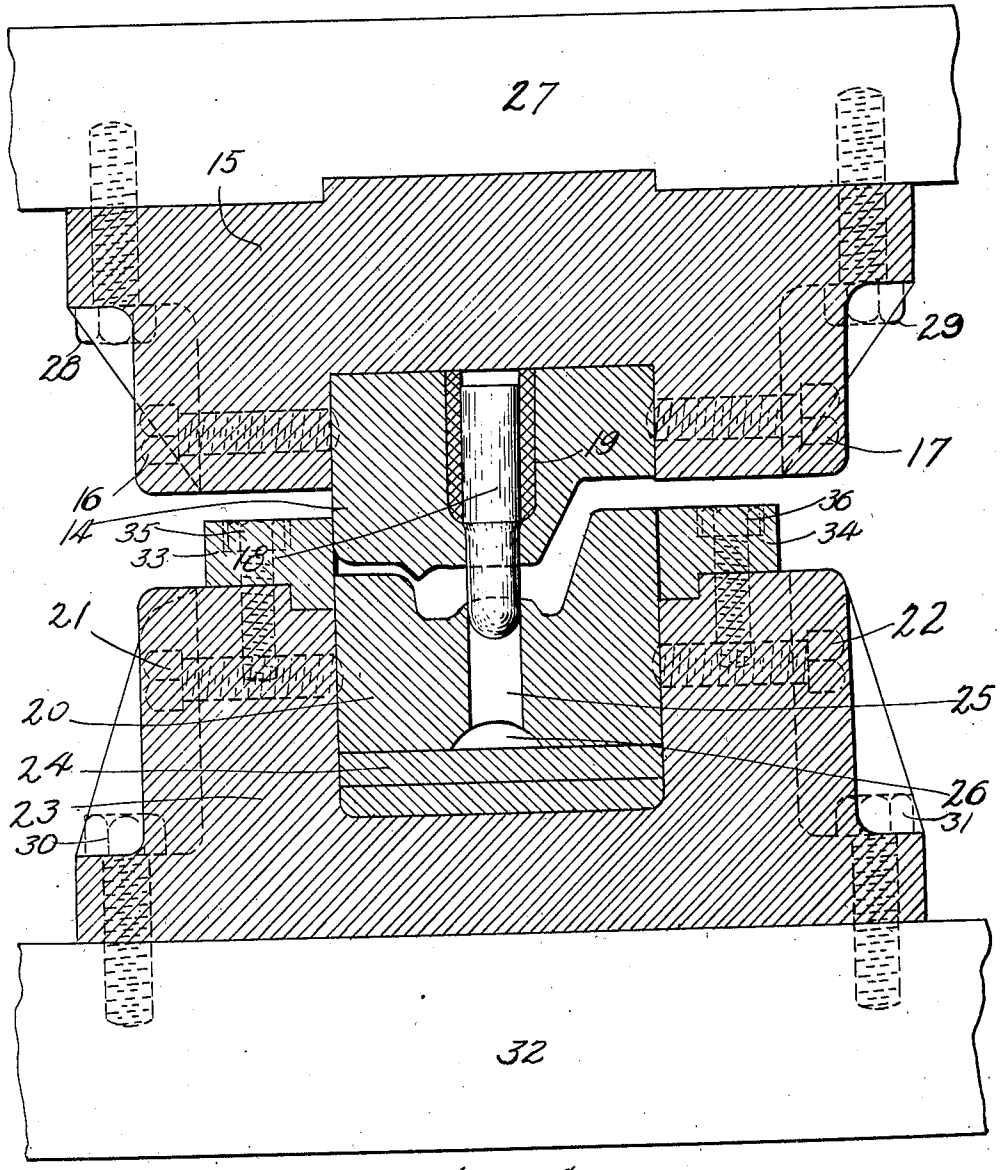


Fig. 4

Inventor
George Langford
By Brown Bottcher & Dinner
Atty's.

Patented Feb. 21, 1928. 1,659,776

UNITED STATES PATENT OFFICE.

GEORGE LANGFORD, OF JOLIET, ILLINOIS, ASSIGNOR TO McKENNA PROCESS COMPANY OF ILLINOIS, OF JOLIET, ILLINOIS, A CORPORATION OF ILLINOIS.

METHOD OF TREATING WORN RAIL JOINTS.

Application filed October 18, 1924. Serial No. 744,328.

My invention relates to a method of treatment of worn rail joints to prolong the useful life thereof for the purpose for which they were originally employed.

Two angle-bars or "fish-plate", one on each side of the rail, with bolts binding them together, constitute the ordinary form of joint for fastening the adjacent ends of rails together in a track. As is well known, a rail joint loses its usefulness when the pounding of train wheels over the rails causes loss, by abrasion or distortion, of metal on the surfaces of the angle bars where they come in close contact with the rail. The rails are no longer held firmly in the vertical direction and the movement under constant service, with increasing wear of the angle bar, becomes so pronounced that the worn angle bars must be replaced with new ones. Meanwhile the two adjacent rail ends have become so battered under the train wheels because of the worn and yielding joint that to insure smooth and safe track, the rails themselves must be replaced with new ones or the damaged ends cut off, thereby shortening the rails and causing great delay and expense establishing them in new positions. Inasmuch as a rail joint costs only about 1/20th of the two rails it fastens together and is far more easily replaced, it would seem desirable to renew the rail joint before it becomes so bady worn as to cause damage to the rail.

I find from discussion with many railroad engineers a growing disposition to prolong the life of rails by replacing old joints with new ones much sooner than formerly so as to avoid damage to the rail ends and my process lends itself very conveniently to this scheme. It is cheaper to renew worn bars than to buy new ones, also non-heat treated bars can then be heat-treated by my process. Formerly the joints were permitted to wear until both joints and rail ends were damaged too much for main line track. Then the rails were removed for use in less important track, sometimes without treatment, sometimes after cutting off the damaged ends and re-drilling for the joints. The least worn of the removed angle bars were again used, those badly worn becoming scrap. From my examination of many scrapped angle bars, it appears that more than 95% of the original metal remains.

The main object of my invention is to restore this large percentage of scrap metal to the same use as that for which it was originally intended, also to renew angle bars before as well as after they become worn enough to cause damage to the rail ends. The novelty of my invention lies in the fact that I renew the fundamental wearing parts of the angle bar without appreciable elongation or reduction in sectional area or change in the dimensions and spacing of bolt-holes so that it may be put back upon the same rail using the same fastening bolts. The worn rail joint is thereby restored to a second useful life.

Railroads have attempted the renewal of angle bars by swedging the metal under blows of a steam hammer, but such a method does not fully restore the fundamental wearing parts nor preserve the size and spacing of bolt holes. I can find no case where such a method prevails for main track use and very few cases where it is employed for secondary track. As a method of renewal it is unsuccessful. To properly renew the section, lateral rather than vertical draughts must be applied. Inasmuch as each angle bar is punched with from four to six holes accurately sized and spaced to conform with the holes drilled in the rail ends, the successful renewal of an angle bar necessitates not merely the renewal of the fundamental wearing parts, but also the renewal or retention of size and spacing of the bolt holes.

Under Langford Patents Nos. 1,212,364 and 1,212,365, of Jan. 16, 1917, badly worn rails are being successfully renewed by re-rolling, but this process so distorts the bolt holes in the rail that they are unserviceable. However, the re-rolling so elongates the rail that the ends and old holes may be cut off without sacrificing the original length, although sacrificing weight per yard as scrap in the discarded rail end. New bolt holes are then drilled in the renewed rail. Were the worn rail punched with bolt holes from end to end and the preservation of size and spacing of these holes essential, renewal by re-rolling would be impossible because of distortion by elongation. I know of no method of renewing rails except by re-rolling nor no method of rolling which does not produce elongation or flow of metal in the direction rolled. Renewing an angle bar by re-rolling is impossible unless some provision is made to restrict elongation and preserve

size and spacing of the bolt holes. I know of no method whereby such provision is made to renew angle bars by re-rolling and my first idea was to insert pins in the rolls so that the holes might be held to size and elongation restricted. However, such a method had too many disadvantages to be successful and it was only in part a renewal so that instead of using rolls I have had recourse to press and dies.

The press and die method permitted spreading of metal to restore the fundamental wearing parts of the bar without appreciable elongation. However, the spreading elongated the holes vertically and narrowed them horizontally so that round holes became ellipses standing on end. To prevent such distortion I incorporated pins and holes in the dies, conforming to the holes in the worn angle bar and the result was successful renewal not merely of the bar's fundamental wearing parts, but also of the size and spacing of bolt holes. An essential feature of my invention is, therefore, the incorporation of pins and holes in the shaping dies in addition to my method of transforming vertical to lateral pressure in the renewal of the cross-section of the bars which will be described later.

I shall now describe more particularly the nature of my invention in order that those skilled in the art may practice the same.

In the accompanying drawings which form a part of the present specification:—

Fig. 1 is an end view of a rail with two angle bars bolted to it to form a joint;

Fig. 2 is a side view of Fig. 1 with holding bolts removed;

Fig. 3 is an end view of a worn angle bar with the orginal unworn parts shown by dotted lines;

Fig. 4 is an end view in section of a top and bottom die fixed, respectively, to the top die holder and the bottom die holder of a power press;

Fig. 5 is a diagrammatic end view of a worn angle bar in position on the bottom die ready to be formed into shape;

Fig. 6 illustrates diagrammatically what first takes place when pressure is applied on the angle bar; and

Fig. 7 is a similar end view of a worn angle bar shaped to conform to the dies.

Fig. 1 represents the common type of rail joint now in use. The bolt holes in each bar are punched alternately round and elliptical so that when a pair of them are joined to a rail, each round hole of one bar lines up with each elliptical hole of the other. Each bolt which fastens the joint has an elliptical shoulder next to the bolt head and this shoulder fits into the elliptical hole of the angle bar so that the bolt will not turn when the nut is tightened up. In place of the illiptical hole, sometimes a square hole is employed, in which case the bolt is square-shouldered.

Although angle bars vary greatly in design, there are certain established principles commonly observed by all users; the angle bar and rail contact surfaces must be accurate in their relations to each other and allowance must be made for wear so that the joint may be held vertically rigid under continued surface. The wearing surfaces are shown in Fig. 1 as 6—7, the head-wearing surface on the rail 2, and 8—9 the flange-wearing surface. It is essential that on these two surfaces, bar and rail must fit accurately and fit tightly to insure rigidity of joint. The great stresses induced by service tend to separate the wearing parts and the two angles bars must then be drawn toward each other by tightening the bolts to maintain the fit of the joint. As the wearing surfaces are designed with convergent angles, wear is overcome by drawing each bar inward. Space at 10 and 11, Fig. 1, is provided for this purpose so that the angle bars will not come in contact with the rail as they are drawn toward each other. When they do come eventually in such contact, the wearing surfaces of rail and bars can no longer be held firmly together. The joint loses its rigidity and must then be replaced by a new one. Therefore to renew the section of angle bar, the height of bar must be restored thereby restoring the draw space, and the wearing surfaces must be made to the original lengths and angles. This is accomplished by spreading in the bottom die, Fig. 4, the tongue of which is convex and slightly wider than the bar recess, the upper die being the surface of pressure. This shifting of metal from near the center or neutral axis, restores as much as is possible, the bar's upper and lower moments of intertia. Any thinning of the bar is to be avoided, except where it is necessary to obliterate corrosion or marks made by the holding nut or bolt head. This necessitates an accurately predetermined stroke, impossible under a hydraulic ram or steam hammer, but possible in a power press. Although I find that worn bars of any one section were as a rule originally rolled with reasonable accuracy, some are worn so much more than others that they must be sorted out and subjected to slightly increased pressure in order that the fundamental wearing parts may be fully restored. This sorting of worn bars for renewal is an important feature of my process. In a press of predetermined stroke, only a slight increase of pressure is needed to renew the more badly worn bars in the same dies used to renew those more moderately worn.

Fig. 2 shows the ends of two rails 12 and 13 with angle bar in place showing bolt holes

with bolts removed. The holes in rails and bar are larger than the holding bolts so that the rails may be free to move slightly to and from each other, thereby permitting expansion or contraction of the rails in extremes of weather and avoiding distortion of track. This longitudinal shifting of the rail upon the angle bars contributes to the wear and destruction of both.

Although the practice of my invention need not be followed in all of its details as I show it, I find the following method is conducive to obtaining satisfactory results.

The worn bars are placed in a furnace and heated to approximately 800° centigrade, above or below as carbon content or other conditions warrant. This is in accordance with modern practice, wherein new angle bars are rolled to long lengths, then sheared when cold into finished lengths and heated in a furnace. The next operation wherein my method and that employed in making new bars differ very materially is where the new bar is punched for bolt holes, the flange slotted for spikes and the bar straightened, the three operations being accomplished hot in three separate machines. In my process three operations are done in the dies at one stroke of the press, however the three operations not being the same as separately employed in the making of new bars. Inasmuch as spike slots generally suffer no such distortion as would impair their usefulness, provision is preferably not made for their consideration, but if desired the spike slots are pegged by the insertion of pins in the dies like the pins which hold the bolt holes in the bars so as to fit into and preserve the slots as the upper die descends. My process renews the section, restores the bolt holes and straightens the bar at a single stroke of the press.

I will now more fully describe the operation of the dies employed in carrying out my invention and embodying the same.

Fig. 4 is an end sectional view of an upper die 14 held in a die-holder 15 by set screws 16 and 17, the die holder being bolted by means of bolts 28 and 29 to the under side of an independently guided "slide" or reciprocating cross head 27 of a power press, capable of delivering an accurately predetermined stroke. A pin 18 incorporated in the upper die, sized and spaced for the old bolt hole, is free to move up and down in a babbitted bearing 19. This pin may be straight, that is, of the same diameter the whole length of its lower or working part, but I find it convenient to taper it so as to facilitate stripping. By "stripping" is meant releasing the angle bar from dies and pins after pressing so that it may be readily ejected from the dies to make way for another worn angle bar to be treated. I find that because of the tapering sides of grooves in the bottom die 20, the bar is less inclined to stick in them than to the pin. The latter being shorter than the babbitted bearing 19, is free to drop and should the bar stick to it, the resultant jolt frees it or at least permits the insertion of a release tool between the bar and the upper die. The taper and vertical motion of the pin is merely a provision for the easy removal of occasional bars that may stick to the pins. The top die 14 moves up and down with each stroke of the press, but the bottom die 20 is immovable, being held by set screws 21 and 22 in a die holder 23, the die holder, in turn, being bolted to the bolster plate 32 of the power press by means of bolts 30 and 31. Left and right side-thrust bars 33 and 34 bolted to the bottom die holder by means of bolts 35 and 36 are also provided to take up any side thrusts of the upper die. A wedge 24 inserted between the die and die holder permits the die to be lined up or down. The press bed has a similar adjustment. The bottom die has a hole 25 to receive the pin in the top die as it descends and a dust groove 26 to carry away particles of metal, oxide and other refuse matter. The pin is rounded at its working extremity so that it may readily enter the hole in the worn angle bar. This hole may be distorted or enlarged by wear, but when subjected to pressure, it is reformed around the inserted pin. The latter prevents distortion of the hole as the bar is spread back to proper section and forms an obstacle to elongation. There being four or six pins accurately spaced according to the number of holes, and their spacing in the angle bar, not only the size but the spacing of worn holes are thereby successfully maintained or restored to their original dimensions.

The process of renewing worn angle bars by my method is more fully illustrated by making reference to Figs. 5, 6 and 7. In Fig. 5 such a bar 27 is shown in normal position on the bottom die 28. When in this position the sides of the recess of the bar will rest on the respective edges of the tongue of the bottom die. In Fig. 5 this contact is shown by points which are indicated by arrowheads and designated by the letters A and C. The bottom surface of the web will come in contact with the highest point of curvature (which curvature is exaggerated in the figures for purposes of illustration) on the convex surface of the tongue of the bottom die. This point is indicated by an arrowhead and designated by the letter B. This tongue is so designed that the highest point of curvature, B, is normal to the neutral axis of the angle bar. The importance of this will be subsequently shown.

Fig. 6 illustrates what first happens when pressure is applied on the angle bar through the top die 29. The reactions at A and C cause the head and flange of the bar to move

outward and upward as indicated by the arrowheads. The reaction at B will cause the tongue of the bottom die to impress itself into the hot metal. In doing so the molecules of metal will be spread from the neutral axis of the bar and forced to the outer extremities of the head and flange to replace worn parts. The molecules in the region where pressure is first applied will necessarily be compelled to travel furthest within the body of the bar. Practically all the metal that is required to fill the dies, i. e., replace the worn parts comes from the region of the neutral axis where pressure is first applied. In taking metal to replace worn parts principally from the region of the neutral axis, any possible weakening of the bar is reduced to a minimum, for the moment of inertia for the bar as used on the rail will be substantially equal to that of the original bar. In effect this is a transformation to a large extent of vertical to lateral pressure to avoid shortening the two wearing surfaces of the bar, as would result from vertical pressure only. I claim this method of renewing worn angle bars by transforming vertical to lateral pressure as new and an essential feature of my invention.

In Fig. 7 the worn bar is shown shaped to conform to the contour of the dies. Surplus metal of the amounts X and Y is squeezed out between the dies at the head and flange parts of the bar respectively. It is essential that enough metal be squeezed out to show that it has been forced to every part of the dies and that the bar, therefore, has been fully renewed. This surplus metal is called "flash" and when excessive must be ground off or removed with a chisel.

After renewal in the dies, the hot bar is finished and permitted to cool undisturbed or more commonly it is immersed while hot in oil thereby improving its tensile strength and other physical qualities.

I find that worn angle bars may be not merely renewed by my method so as to be replaced upon the same rails from which they were originally discarded, but may be altered to fit rails of different section. Also worn bars of old design may be renewed to new designs containing improvements over the old. However, in all cases I retain the substance of my invention, the hole-forming pins and holes and the widened tongue incorporated in the dies.

I claim:—

1. In a device of the class described, a pair of open ended die members longitudinally channelled to receive between them a worn angle bar, said dies having holes registering with each other and adapted to register with the bolt holes of the worn bar, guiding and forming pins mounted in the holes of one of said die members for limited axial movement therein and adapted to enter the holes in the other die member, said pins guiding the bar into proper register in the die, and providing forming means for forming the bolt holes to the desired size and spacing when the bar is formed between the dies by a predetermined pressure of the dies upon the bar between them.

2. In a device of the class described, a pair of open ended complementary die members longitudinally shaped to receive between them a worn angle bar, said die members having registering holes adapted to register with the bolt holes of the worn angle bar to be treated, guiding and forming pins mounted in the holes of one of said die members and adapted to enter the holes in the other die member, said first die member having limited axial movement with respect to said pins, said pins being projected through the holes in the angle bar to be treated and into the holes of the co-operating die member, and providing forming and spacing means for forming and spacing the bolt holes when the die members are close together.

3. The method of reforming bolt holes in worn angle bars which comprises introducing pins into the bolt holes, then compressing the metal of the bar about said bolt holes by pressure applied upon opposite sides of the bar in a direction parallel to the axis of the pins to cause the metal on the margins of the bolt holes to flow laterally and to embrace the pins, and during said applied pressure restraining the pins laterally while the pins remain stationary axially.

4. In a device of the class described, the combination of a stationary lower die member having a convergent recess for receiving a blank to be pressed to form, a movable upper die member, said members having registering holes, a pin seated in the hole in the upper die member and having a lost motion connection axially therewith, said pin being adapted to be passed through a hole in the blank and to enter the registering hole in the lower die member before the die members are fully closed upon the blank, final closing movement of the die members upon the blank pressing the metal against the lateral surfaces of the pin while the pin stands stationary relative thereto.

In witness whereof, I hereunto subscribe my name this 11th day of October, 1924.

GEORGE LANGFORD.