April 15, 1941. H. L. LANSING 2,238,652

RAILWAY RAIL

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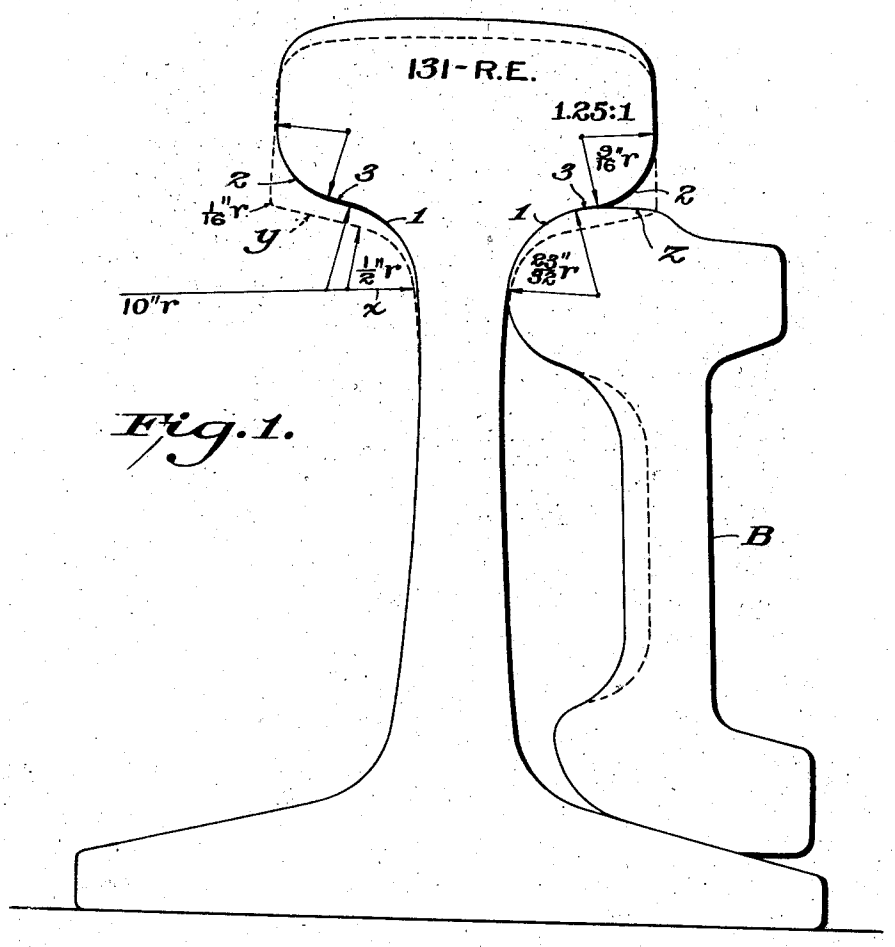


Fig. 1.

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Fig. 5.

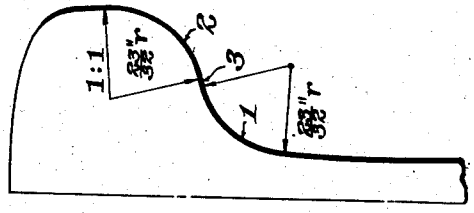


Fig. 4.

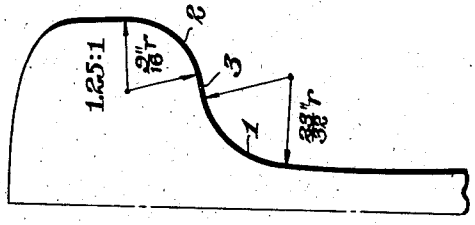


Fig. 3.

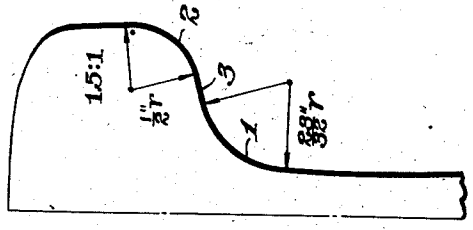
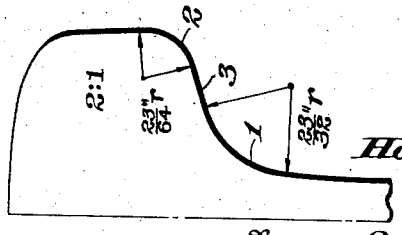


Fig. 2.



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RAILWAY RAIL

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Application March 22, 1940, Serial No. 325,439

5 Claims. (Cl. 238—125)

This invention relates to railway rails of the T-rail type and has for its primary object to provide a novel rail head formation having pronounced improvement in its physical properties, and in other important particulars, over a comparable standard T-rail and also providing for the use of an improved rail joint bar with improved physical properties and a better distribution of metal therein than the comparable joint bar employed with the said comparable standard rail.

It is well known that even small changes in the section and relative proportion of parts in a railway rail and/or joint bar, materially affect proper cooling thereof in manufacture, as well as the physical properties of same, and so the changes provided by the present invention over a comparable standard rail and joint bar contribute directly to the production of a modified T-rail and joint bar having many desirable advantages.

Among the more particular advantages, attributable to the present invention are that, for the same amount of metal used, the new rail will have a greater moment of inertia or stiffness than the comparable standard T-rail which it modifies, and at the same time may have a greater height of fishing space for the joint bar than the comparable standard rail, thereby permitting the use of a stronger joint bar of generally better physical properties than the comparable bar used with the standard rail.

In brief, the present invention particularly provides a novel interfillet relationship between the head fillets and lower outer corner fillets of the rail head, whereby there is obtained far less stress concentration in the head fillets, a more uniform stress distribution in the web and a more uniform cooling of the metal in the zone of the head fillets than in a comparable standard T-rail, for example, in a comparable A. R. E. A. standard T-rail of a substantially equal cross sectional area. In addition the said novel interfillet relationship provides a better distribution of stresses in critical locations, a better cooling in the zone of the head fillets, a higher moment of inertia, and greater abrasion head-wear than in the comparable standard T-rail; or, if desired, said interfillet relationship may be utilized to provide, with the same abrasion head-wear as in the comparable standard T-rail, a rail having a much higher moment of inertia, better cooling and better distribution of stresses than is obtainable in the said comparable standard T-rail.

With the foregoing and other objects in view, which will more readily appear as the nature of the invention is better understood, the same consists in the novel features of construction, combination and arrangement of parts as will be hereinafter more fully described, illustrated in the accompanying drawings and defined in the appended claims.

In the accompanying drawings, wherein like characters of reference denote corresponding parts in the different views:

Figure 1 is a view of the new rail superimposed upon a comparable standard T-rail, typified by the standard 131 lb. R. E. rail.

Figures 2, 3, 4 and 5 are a series of views of the new rail head structure showing the various radii involved and illustrating the range of the invention with respect to the relation of the head-web fillet and the outer bottom corner fillet of the rail head.

In carrying forward the present invention a fundamental feature thereof is to provide an enlarged joint bearing fillet **1** connecting the head with the web of the rail, such fillet being on a long sweeping curve having a radius materially greater than the radius of the corresponding fillet of a standard comparable rail, and an enlarged fillet **2** at the bottom corner of the rail head likewise having a radius materially greater than the radius of the comparable standard rail. These two fillets, **1** and **2**, are preferably combined with an intervening short tangent **3** operating to have a restraining action on upward and outward movement of the head of the joint bar thus holding the same in its applied and tightly bolted condition close to the rail web.

As shown in Figure 1 of the drawings, a standard comparable T-rail is typified for example by a 131 lb. A. R. E. A. rail, the head portion of which is illustrated by dotted lines. The upper portion of this standard T-rail has its web struck on a 10'' radius terminating at its upper end, as shown by the arrow at x, and the head fillet thereof is shown to be struck on a ½'' radius, which is connected by a long tangent y with a small $\frac{1}{16}$'' radius at the bottom corner of the rail head. In said figure of the drawings the new modified rail head structure, illustrated by full lines is superimposed upon this standard comparable rail. It will be here observed that a radical change is provided by the new structure in the disposition of the said enlarged head fillet **1** which is struck on a radius materially greater than the corresponding radius of the standard rail, the said head fillet radius of the new rail, for purposes of comparison, being shown as $\frac{33}{64}$''. The center point of this radius is, in the example shown, approximately in the

horizontal plane of the center point of the radius of the head fillet of the standard rail and a sufficient distance beyond the said center point of the radius of the head fillet of the standard rail which would have the effect, in this embodiment of the invention, of causing the head fillet of the new rail to extend definitely above the fishing surface at the underside of the head of the said comparable standard T-rail, thereby correspondingly elevating the entire head of the new rail as compared with the head of the standard T-rail, with the result of imparting to the new rail greater stiffness and strength than the comparable standard rail. As to the fillet 2 of the new rail head at the bottom corner thereof in the selected example, shown in Figures 1 and 4 of the drawings, the same is struck on a radius of $\frac{9}{16}$" which is very materially greater than the $\frac{1}{16}$" radius at the bottom corner of the comparable 131 lb. standard rail. In other words in this example of the invention, the entire underside of the modified new rail structure is carried upward a distance above the head and corner fillets of the said comparable standard rail, and above the tangent *y* thereof. Moreover, the top surface of the new rail is correspondingly elevated above the top surface of the comparable standard rail. Therefore, there is provided a new rail structure of far better physical properties than the comparable 131 lb. standard rail.

Thus it will be seen that a feature of practical importance, according to the present invention, is the said novel interfillet relationship provided at the underside of the rail head involving the use of enlarged inner and outer fillets definitely related to a certain radius range, as shown in Figures 2, 3, 4 and 5 of the drawings to obtain the desired results. Also, the intervening tangent between these two fillets cooperates, as stated, with the head of the joint bar to prevent or retard the same from working up and out of place under load, this function of the tangent operating to minimize wear between the rail and the joint.

As to the radius relationship of the inner head web fillet 1 and the outer bottom corner fillet 2, this provides for a better distribution of the load stresses imposed on the rail so that such stresses will not be concentrated at the head fillet as usually occurs in the standard rail. The relationship range between the fillets referred to is diagrammatically illustrated in Figures 2, 3, 4 and 5 and lies between a two to one and a one to one ratio of said fillets as shown respectively in Figs. 2 and 5. In this range it is preferable to have the head fillet of the rail of the same or approximately the same radius in all forms of the invention, that is, with a radius of $\frac{13}{32}$". A preferable ratio between the said two fillets is shown in Figs. 1 and 4 of the drawings, that is, a ratio in which the head web fillet of $\frac{13}{32}$" is one and one-fourth times the $\frac{9}{16}$" radius of the bottom corner fillet of the rail head, that is to say, the head fillets and lower outer corner fillets are both of greater radii than the corresponding fillets of the comparable standard T-rail, and the radii of the lower outer corner fillets are not less than one-half the radii of the head fillets and not greater than the radii of the head fillets. While it may be said that optimum results are obtained by the ratio of the fillets shown in Figs. 1 and 4 of the drawings it will be understood that the invention is manifested as an improvement upon the comparable standard rail in the maximum and minimum ratios shown in the Figs. 2 and 5 of the drawings.

By reason of the relatively larger outer bottom corner fillet of the rail head the joint bars are permitted to have an apexless ball and socket head engagement with the underside of the rail head. That is to say, there is less stress concentration on the joint bar due to enlarged fillet engagement, lack of sharp apex metal at the top of the joint bar and inability of maximum bearing stress to occur at the point of maximum bending stress. Also, it is obvious that the joint bar employed with the new rail structure may be of greater stiffness than the comparable joint bar because of the sharp upward sweep of the upper, inner corner of its head for contacting the head fillets of the new rail. Moreover, the joint bar necessarily will have a greater head bearing area, lower stress and better distribution of metal than the comparable bar for use with the comparable standard T-rail.

The joint bar B employed is preferably of a type having an enlarged rounded bearing head completely filling the head fillet of the rail and having a rounded top surface sweeping outwardly and downwardly, as at *z*, so as to avoid sharp apex metal and to entirely clear the bottom rounded corner 2 of the rail head.

A mathematical illustration of the advantages of the present invention, in comparison with the comparable standard rail and joint bar which it modifies is shown by the following tables, that is to say:

The comparable 131 lb. R. E. rail has the following physical properties:

Moment of inertia	88.5
Section modulus top	22.6
Section modulus bottom	27.6

The new rail, according to Fig. 1, which is a modification of the said comparable standard rail has the following physical properties:

Moment of inertia	92.1
Section modulus top	23.0
Section modulus bottom	28.2

These two tables show that the new rail presents, without increase of metal a materially greater moment of inertia greater than that of the comparable standard rail with a distribution of metal throughout the head structure better adapted for cooling than the head structure of the standard rail.

Taking a joint bar of standard type usable with the said standard comparable rail the physical properties of such bar are:

Moment of inertia	32.0
Section modulus top	12.6
Section modulus bottom	12.6

An improved joint bar of the same weight as the comparable prior bar adaptable to the under head structure of the new rail and to the higher fishing thereof according to the present invention has the following physical properties:

Moment of inertia	35.0
Section modulus top	14.1
Section modulus bottom	13.0

Therefore, it will be seen that with respect to a joint bar for use with the new rail of the present invention the same has a materially greater moment of inertia than the comparable joint bar and also a better distribution of metal throughout.

From the foregoing it is thought that the structural features and advantages of the invention,

within the appended claims will be readily understood.

I claim:

1. A railway rail having in its head portion a new interfillet relationship as compared with a standard T-rail, e. g., an A. R. E. A. standard T-rail of substantially equal cross sectional area, the said new interfillet relationship comprising head fillets and lower outer corner fillets both of greater radii than the corresponding fillets of said comparable rail, the radii of the lower outer corner fillets being not less than one-half the radii of the head fillets and not greater than the radii of the head fillets, whereby stress concentration in the head fillets is reduced and more uniform cooling is obtained in the head fillet zone than in the said comparable rail.

2. A railway rail having in its head portion a new interfillet relationship as compared with a standard T-rail, e. g., an A. R. E. A. standard T-rail of substantially equal cross sectional area, the said new interfillet relationship comprising head fillets and lower outer corner fillets both of greater radii than the corresponding fillets of said comparable rail, the radii of the lower outer corner fillets being not less than one-half the radii of the head fillets and not greater than the radii of the head fillets, whereby stress concentration in the head fillets is reduced and more uniform cooling in the head fillet zone of the rail is obtained than in the said comparable rail, the tops of said head fillets being disposed higher above the base of the rail than the tops of the head fillets of the said comparable rail.

3. A railway rail having in its head portion a new interfillet relationship as compared with a standard T-rail, e. g., an A. R. E. A. standard T-rail of substantially equal cross sectional area, the said new interfillet relationship comprising head fillets and lower outer corner fillets both of greater radii than the corresponding fillets of said comparable rail, the radii of the lower outer corner fillets being not less than one-half the radii of the head fillets and not greater than the radii of the head fillets, whereby stress concentration in the head fillets is reduced and more uniform cooling in the head fillet zone of the rail is obtained than in the comparable standard T-rail, the top of the head and the tops of the said head fillets being disposed higher above the base of the rail than the top of the head and the tops of the head fillets, respectively, of the said comparable rail.

4. A railway rail having in its head portion a new interfillet relationship as compared with a standard T-rail, e. g., an A. R. E. A. standard T-rail of substantially equal cross sectional area, the said new interfillet relationship comprising head fillets and lower outer corner fillets both of greater radii than the corresponding fillets of said comparable rail, the radii of the lower outer corner fillets being not less than one-half the radii of the head fillets and not greater than the radii of the head fillets, whereby stress concentration in the head fillets is reduced and more uniform cooling in the head fillet zone of the rail is obtained than in the said comparable rail, the under side of the head of said rail having flat upwardly and outwardly extending faces between and tangent to related head and corner fillets, respectively.

5. A railway rail having in its head portion a new interfillet relationship as compared with a standard T-rail, e. g., an A. R. E. A. standard T-rail of substantially equal cross sectional area, the said new interfillet relationship comprising head fillets and lower outer corner fillets both of greater radii than the corresponding fillets of said comparable rail, the radii of the lower outer corner fillets being not less than one-half the radii of the head fillets and not greater than the radii of the head fillets, whereby stress concentration in the head fillets is reduced and more uniform cooling in the head fillet zone of the rail is obtained than in the said comparable rail, the top of the head and the tops of the said head fillets being disposed higher above the base of the rail than the top of the head and the tops of the head fillets, respectively, of the said comparable rail, and joint bars having rounded upper inner corners substantially conforming in contour to said head fillets and having loading engagement therewith, said joint bars having a greater moment of inertia than joint bars fitting the said comparable rail.

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