March 19, 1946. R. J. LLOYD 2,397,023

TIE-PLATE

Filed Feb. 3, 1945 2 Sheets-Sheet 1

Fig. 1.

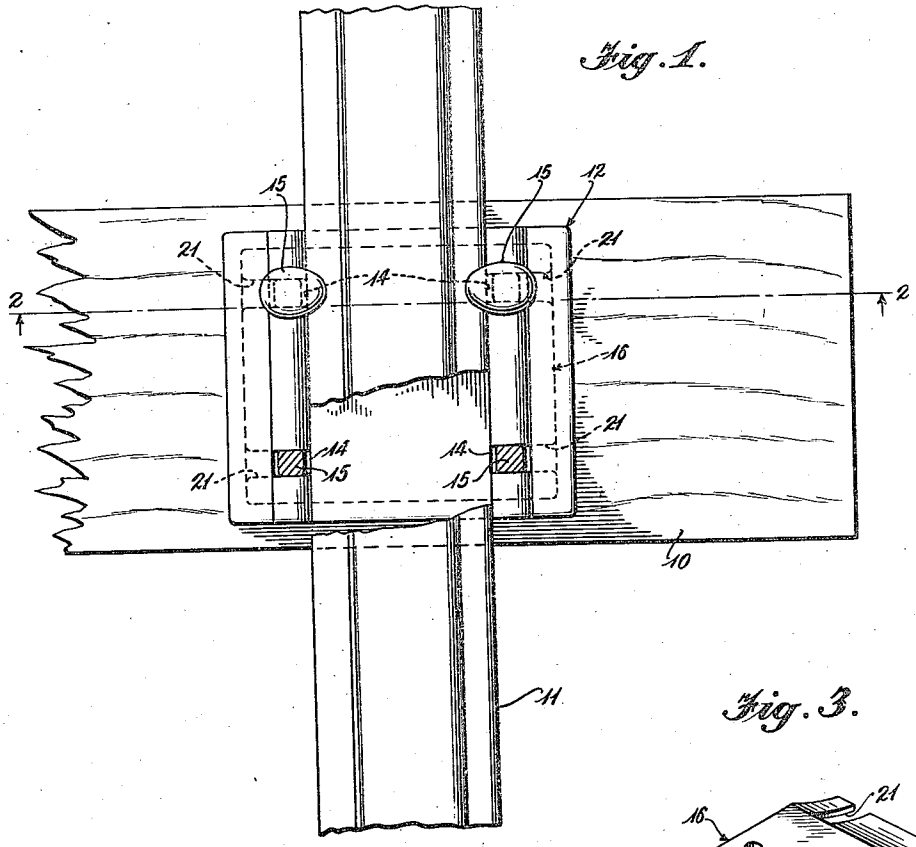


Fig. 3.

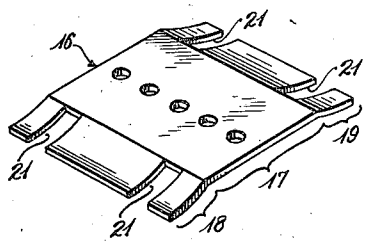
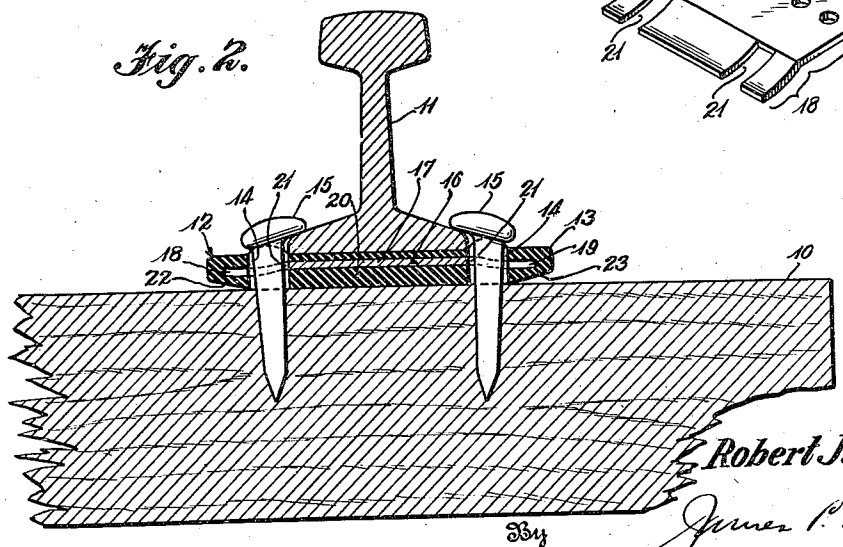


Fig. 2.



Inventor

Robert J. Lloyd

By James P. Burns

Attorney

March 19, 1946. R. J. LLOYD 2,397,023

TIE-PLATE

Filed Feb. 3, 1945 2 Sheets-Sheet 2

Fig. 4.

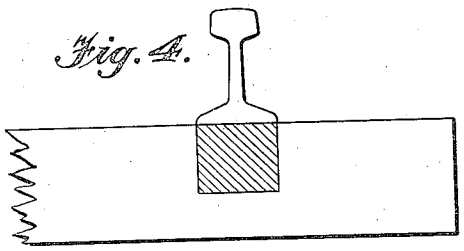


Fig. 5.

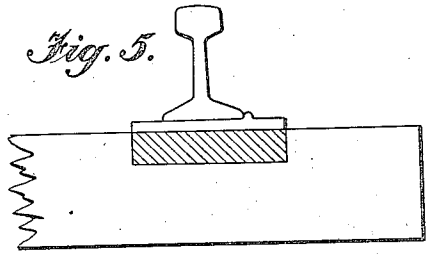


Fig. 6.

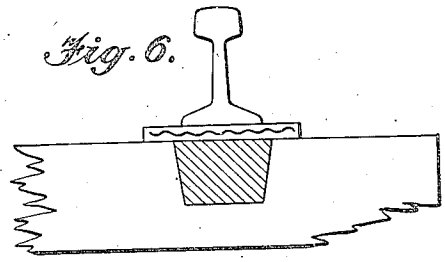


Fig. 7.

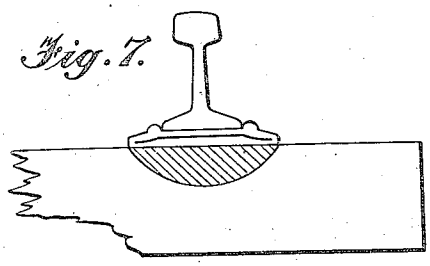
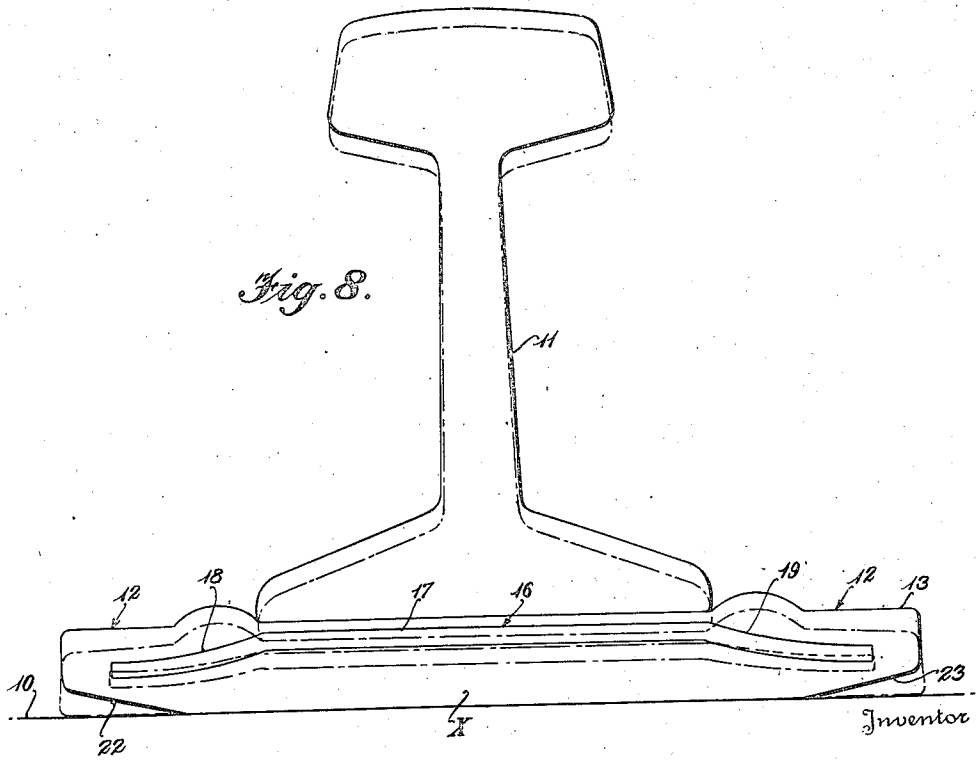


Fig. 8.



Inventor

Robert J. Lloyd

By James P. Burns

Attorney

Patented Mar. 19, 1946

2,397,023

UNITED STATES PATENT OFFICE

2,397,023

TIE PLATE

Robert J. Lloyd, Arlington, Va.

Application February 3, 1945, Serial No. 576,037

5 Claims. (Cl. 238—283)

This invention relates to a novel tie-plate for use in the securing of railroad and like rails to cross-ties.

It has long been the practice to employ steel tie-plates between the rail and cross-ties to distribute the stress, resulting from the passage of trains over the rails, throughout a greater area of the cross-tie than that represented by the bottom or base flange of the rail itself. This practice has been resorted to with a view to reducing the liability of cutting the wood fibers of the cross-tie, thereby rendering the cross-tie in time unfit for use. At the present time the life of cross-ties is determined very largely by factors of mechanical wear rather than by physical decay.

It is one of the broad objects of the present invention to provide a novel resilient tie-plate adapted to extend the life of cross-ties as governed by mechanical wear to be commensurate with their life as governed by physical decay.

The present invention is unique in that it provides a proper distribution of load stresses, resulting from passage of the trains, in the cross-tie without utilizing a harness, jacket or auxiliary equipment of any kind, while at the same time providing all of the advantages of rubber in cushioning shocks on the rails, cross-ties, roadbed, locomotive and rolling stock.

In its more specific aspects the invention contemplates the provision of a novel resilient tie-plate comprising a block of vulcanized rubber in which is embedded a deformed metal plate so constructed as to function not merely as a reinforcement, but as an active element to distribute the load stresses, resulting from the passage of trains, to the cross-ties in such manner as to minimize the cutting of fibers and mechanical wear.

The invention will be described by reference to the accompanying drawings forming a part hereof, in which:

Figure 1 is a top plan view with parts broken away showing the position of the novel tie-plate in relation to a rail and cross-tie.

Figure 2 is a sectional view on the line 2—2 of Figure 1, illustrating the position of the tie-plate when not under load.

Figure 3 is a detail view of the deformed metal insert employed in the molded rubber tie-plate.

Figure 4 is a diagrammatic view illustrating the stress diagram of the stresses imparted to a cross-tie when no tie-plate is used.

Figure 5 is a diagrammatic view illustrating the stress diagram of the stresses imparted to a cross-tie when a conventional steel tie-plate is employed.

Figure 6 is a diagrammatic view illustrating a stress diagram of the stresses imparted to a cross-tie when a conventional reinforced rubber tie-plate is employed.

Figure 7 is a diagrammatic view illustrating a stress diagram of the stresses imparted to a cross-tie employing a tie-plate of the present invention.

Figure 8 is an enlarged view showing in full lines the position of the rail and the elements of the tie-plate when in unstressed condition, and illustrating in dotted lines the position assumed by the rail and the elements of the tie-plate when under load.

Referring to Figure 1, the reference character 10 illustrates a conventional cross-tie for supporting the conventional rail 11. The tie-plate of the instant invention is indicated generally by the reference character 12, and comprises the vulcanized rubber block 13 which may be molded from natural, synthetic or reclaimed rubber, or any suitable combination of them, to appropriate shape for application to different sizes and sections of railroad rails. It is to be understood that the term "rubber" as used herein is employed generally to embrace the various forms of natural, synthetic and reclaimed rubber. The tie-plate 12 has four openings therethrough, indicated generally at 14, to accommodate the conventional railroad spikes 15 employed to hold the rail 11 in position on the cross-tie 10. The openings 14 are such as to permit relatively free movement of the tie-plate 12 with respect to the spikes 15 in assuming the position occupied thereby when under load. There is embedded in the vulcanized rubber block 13 a load distributing metal plate 16. The central portion 17 of this plate is of a width substantially that of the base flange of the rail with which the plate is to be associated. The side portions 18 and 19 extending parallel with the rail are deflected downwardly so that together with the central portion 17 they provide a lower recessed area within which a substantial body of the molded rubber lies as indicated at 20.

In Figure 2 the load distributing plate 16 is apertured or slotted as indicated at 21 to accommodate the spikes 15. The molded rubber block 13 is preferably so formed that the side portions thereof extend upwardly at an angle from the cross-tie as indicated at 22 and 23 in Figure 2. These angles on the bottom surface of the molded rubber plate are important in that they are used in conjunction with the embedded deformed

metal plate 16 to distribute the load stresses over a greater area of the cross-tie than would be possible without a tie-plate or by use of a tie-plate reinforced only against crushing or flattening, and in a far more suitably graduated manner than is possible through the use of a steel tie-plate alone.

Referring to Figures 4 to 7, it will be observed when a rail is used on a cross-tie without a tie-plate, as indicated in Figure 4, the stresses are substantially straight line stresses and tend to cut the fibers along lines parallel to the side edges of the base flange of the rail. When a steel tie-plate is used, the stresses are merely distributed to a greater area of the cross-tie, but they still are substantially straight line stresses, and tend to cut the fibers of the cross-tie along the side edges of the metal tie-plate. When a reinforced flexible tie plate is used the stresses are still substantially straight line stresses, and are not distributed to as great an area of the cross-tie as when a steel tie-plate is employed. The diagrammatic illustrations of Figure 6 substantially represent the type of stress diagram produced when using a flexible tie-plate reinforced against flattening and distortion.

In accordance with the present invention a certain amount of distortion under load is contemplated and provided for. Advantage is taken of this distortion feature to distribute the load stresses to the cross-tie in a gradual manner to minimize cutting action and mechanical rupture thereof. The form of stress diagram shown in Figure 7 diagrammatically illustrates the manner in which the load stresses are distributed to the cross-tie when tie-plates of the present invention are employed.

Figure 8 illustrates the action of the tie-plate of the present invention and shows the unstressed configuration thereof in full lines. When a load is placed on the rail resulting from the passage of rolling stock thereover, the deformed metal plate 16 embedded in the rubber block 13 assumes substantially the dotted line position shown in Figure 8. It will also be observed that the plate 16 offers substantial resistance to the lateral expansion of that portion of the rubber indicated at X located beneath the plate 16. As the rubber at X expands laterally, the wings or marginal side portions 18 and 19 of the plate 16 are forced to move outward and upward around their respective lines of junction with the mid-portion 17. This action, combined with the angles at the bottom of the tie-plate indicated at 22 and 23, serves to distribute the downward stress to the cross-tie through the plate 16 and expanded rubber at X in such fashion that there is a gradual building up of the stresses in the cross-tie from the portions thereof lying beneath the side edges of the tie-plate to that portion thereof lying beneath the center of the tie-plate. The distribution of load stresses in this manner very effectively reduces the tendency of the load to cut the fibers of the cross-tie, and contributes materially to a reduction in mechanical wear and lengthening of cross-tie life.

The advantages of the invention, in addition to the lengthening of cross-tie life due to lessening of mechanical wear, may be summarized as follows: Reduction of wear on the roadbed due to the absorption of combined impact and weight loads in part in the resilient tie plates; reduction of so-called mud pumping by cross-ties because of lessening the vertical motion of the cross-tie under load; lengthening of rail life due to increasing the extent of the rail length which bends under traffic load resulting from the suspension of the rail on the resilient deformable tie-plates, thus lessening the tendency toward fatigue, transverse fissures, and consequent broken rails; reduction of shock to rolling stock and locomotives; lessening of noise, particularly where tracks are on elevated structures or in buildings; and, finally, marked simplicity and low cost of manufacture.

It is to be understood that the dimensions and weight of the deformed metal plate which is embedded in the rubber of the tie-plate of the present invention will be determined in each instance to suit the proper transmission of stresses for the size and weight of rails with which the tie plates may be employed. Likewise, the quantity and character of the rubber employed in producing the tie plate may be varied to meet the particular requirements as to load and rail size. It is within the contemplation of the invention to provide the deformed metal plate with multiple apertures as shown in Fig. 3 and/or with a coating or bonding cement to insure a close and uniform bond between the same and the rubber of the molded block.

While the term cross-tie has been used in this specification to denote primarily a wooden cross-tie, such as generally used in railway track construction, it is not desired to limit the invention to use of the tie-plate with such a cross-tie. While the advantages concerned with longer cross-tie life are derived primarily when wooden cross-ties are used, many of the other advantages are secured when cross-ties of other materials, such as steel, reinforced concrete and the like, are employed. Obviously, when used with steel or concrete cross-ties, the tie plate of this invention is secured thereto through the medium of bolts or other suitable means.

It is to be understood that the foregoing specification is given by way of explanation and not in limitation of the invention which is comprehended by the subjoined claims.

What I claim is:

1. A tie-plate comprising a load-distributing metal plate embedded in a block of molded rubber, said metal plate having a flat central portion and a pair only of downwardly deflecting side portions extending parallel with the side edges of the rail base with which the plate is associated, said deflecting side portions being so shaped that under load the plate offers resistance to the lateral expansion of that portion of the rubber block beneath it, and serves to distribute the downward stress to the cross-tie in such manner that the stress in the cross-tie gradually increases from the side edges of the tie-plate to a point below the center line thereof.

2. A tie-plate comprising a load-distributing metal plate embedded in and surrounded by a block of molded rubber, the two side portions only of said metal plate being deflected downwardly and the mid-portion of said plate having a width substantially that of the rail base with which the tie-plate is adapted to be associated, whereby said metal plate offers resistance to the lateral expansion of the rubber of the rubber molded block beneath said plate and serves to distribute the downward stress to the cross-tie.

3. A tie-plate comprising a block of molded rubber having a load-distributing metal plate embedded therein and surrounded thereby, said load-distributing plate embracing a central portion which throughout its extent is in substantial

parallelism with the top and bottom faces of the molded rubber block, and a pair of side portions only of said metal plate being deflected downwardly from said central portion, whereby said plate offers resistance to the lateral expansion of the rubber of the block beneath it and serves to distribute the downward stress to the cross-tie.

4. A tie-plate comprising a molded block of rubber having embedded therein and surrounded thereby a metal plate, said metal plate embracing a central portion having a width substantially equal to that of the rail base with which the tie-plate is to be associated, and marginal side portions deflected downwardly from said central plate, the lower face of said rubber block when in unstressed condition having upwardly inclined marginal edges.

5. A tie-plate comprising a molded block of rubber having embedded therein and surrounded thereby a metal plate, said metal plate embracing a central portion having a width substantially equal to that of the rail base with which the tie-plate is to be associated, and marginal side portions deflected downwardly from said central plate, the lower face of said rubber block when in unstressed condition having upwardly inclined marginal edges, and the upper face of said rubber block being provided with longitudinal ribs positioned to lie in juxtaposition to the sides of a rail base with which the tie-plate is associated.

ROBERT J. LLOYD.