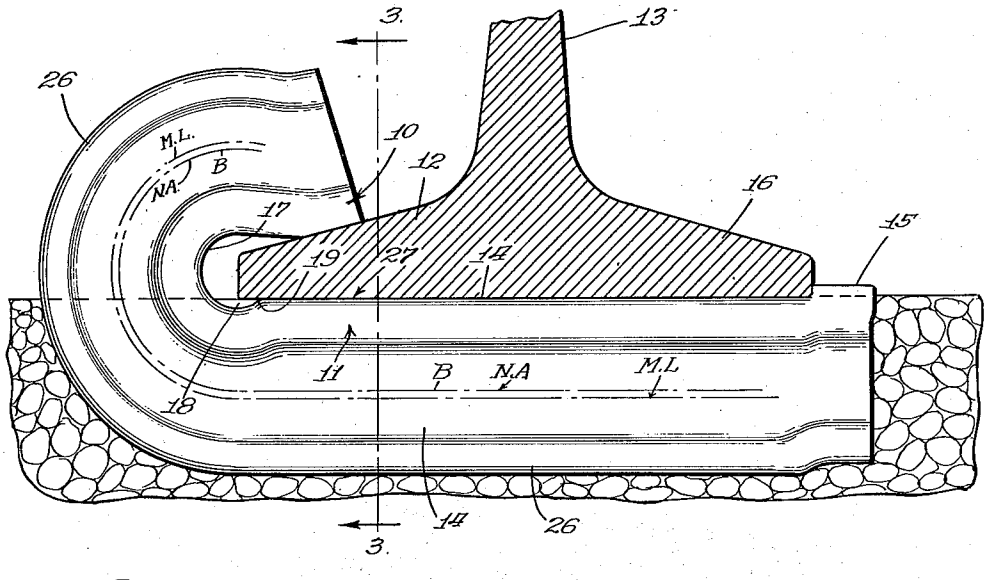
Oct. 16, 1951 V. C. ARMSTRONG 2,571,648

RAIL ANCHOR

Filed May 25, 1948 2 SHEETS—SHEET 1

Fig. 1.



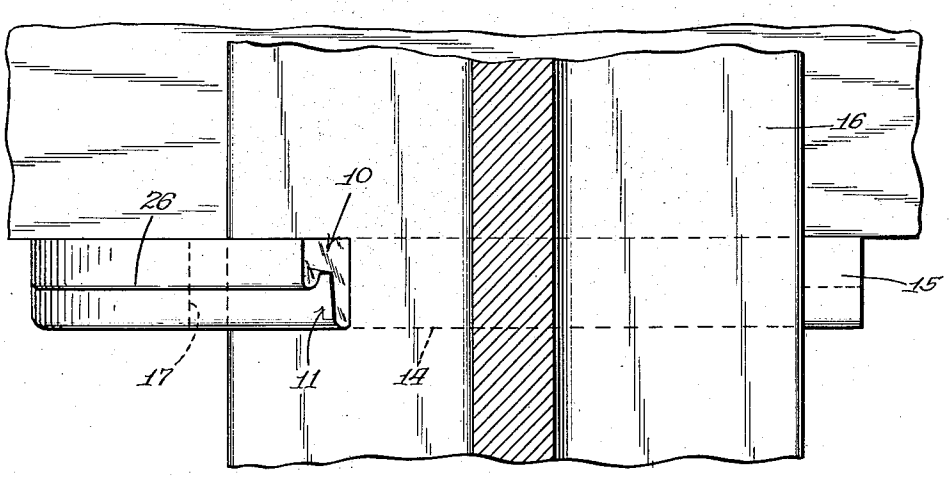


Fig. 2.

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Fig. 3.

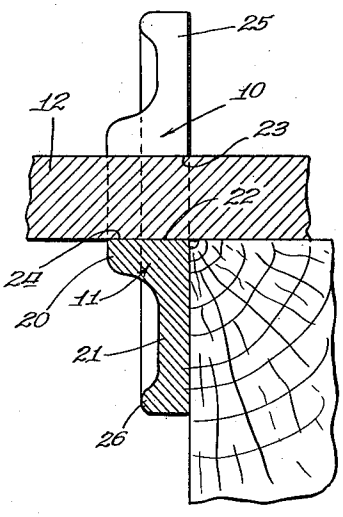
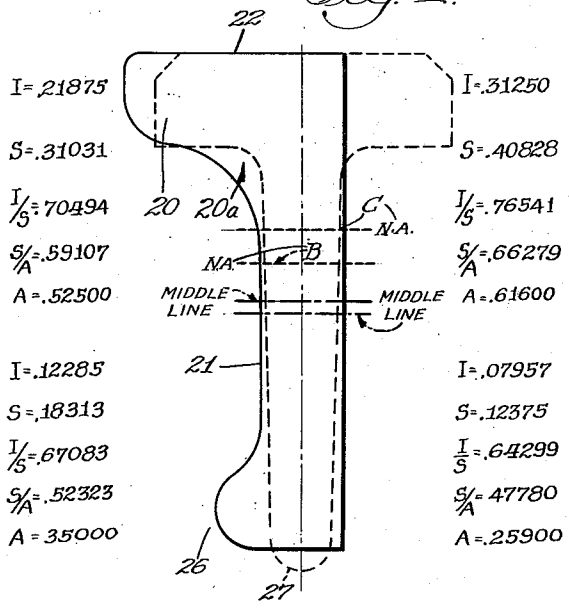


Fig. 4.



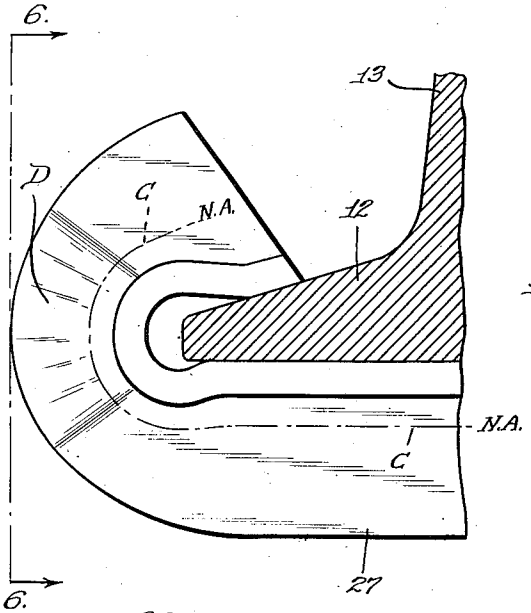
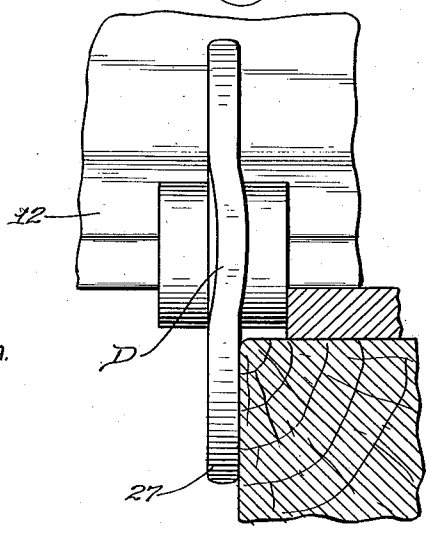


Fig. 5.

Fig. 6.



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2,571,648

UNITED STATES PATENT OFFICE

2,571,648

RAIL ANCHOR

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Application May 25, 1948, Serial No. 29,072

4 Claims. (Cl. 238—327)

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This invention relates to certain new and useful improvements in rail anchors of the general type in which a bar is formed at one end with a hook which provides upper and lower jaws adapted to be driven transversely of a railroad rail into spring gripping engagement with the top and bottom surfaces of the base portion of the rail.

In a rail anchor of the above type the upper jaw is flexed upwardly relative to the body of the anchor device during movement of the jaw upwardly and inwardly to its applied position on the inclined top surface of said base portion of the rail. In such case, the metal at the curve of the hook which lies between the neutral longitudinal axis and the outer curved surface of the hook is subjected to compression. If the compression in that portion of the hook which lies on the compression side of the neutral axis is substantially greater than the stretch on the tension side of said neutral axis, there is a tendency to bow the compression side laterally. While this lateral bending of the compression side of the bar is undesirable, in that it reduces the gripping force exerted by the jaw, the anchor device will continue to function. However, if the metal of the bar which lies on the tension side of the neutral axis is insufficient to withstand the tension imposed thereon, the hook portion of the anchor, when it is flexed outwardly from the anchor body, will assume a permanent set. In many instances, the bar will be fractured at some location along the surface of the inner curved surface of the hook and thereby so release the grip of the hook on the rail base that the anchor becomes ineffective to hold the railroad rail against longitudinal creeping movements. It is desirable, therefore, to so distribute the metal in the bar from which the rail anchor is to be made that the metal at the tension side of the neutral axis of the bar will be sufficient to resist the normal strains and also provide a suitable factor of safety. It is also highly desirable that the neutral longitudinal axis of the metal which forms the hook shall be so positioned relative to the outer curved surface of the hook that this metal will withstand the compression with little or no tendency to yield or bend laterally when the hook is flexed vertically, during the application of the anchor to a rail base flange or during the presence of a force tending to tilt the anchor about an axis extending transversely of the rail. In addition to distributing the metal to substantially balance the tension and compressive displacements in the hook end portion of the anchor, it is also desirable to provide the anchor device with a tie abutting surface which will bear flat against a vertical face of a cross-tie without overlying the top surface of the tie.

A principal object of the present invention is

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to provide an anchor of the "hook form" above discussed in which:

(1) The metal is so distributed in the bar from which the anchor is formed that the anchor provides maximum strength for resisting the above mentioned tension and compressive forces imposed on the hook portion thereof when the hook is spread apart during its application to a rail or during the presence of other forces tending to spread the jaws apart.

(2) The said bar provides a flat tie abutting surface which extends the full height of the anchor body and therefore provides a large bearing area for engaging the cross-tie.

(3) The anchor body has a cross-sectional configuration having one flat side and having a section, while being geometrically unsymmetrical, is substantially balanced as to its I/S and S/A ratios above and below the middle line of the section.

(4) The bar provides a suitable amount of metal adjacent the outer curvature of the hook to receive the percussive force of a driving implement during the application of the anchor to a railroad rail.

The invention is illustrated in the accompanying drawings wherein:

Fig. 1 is a face view of a rail anchor device constructed in accordance with this invention, applied to the base portion of a railroad rail in a position to bear against an adjacent cross-tie;

Fig. 2 is a plan view of the structure shown in Fig. 1.

Fig. 3 is a sectional view taken on line 3—3 of Fig. 1 illustrating the manner in which the anchor engages a vertical face of a cross-tie;

Fig. 4 shows an enlarged sectional view of a bar from which the anchor is made superposed on a T-bar section of corresponding area so as to show, by comparison, the advantages of the improved metal ratios present in the rail anchor of the present invention;

Fig. 5 is a fragmentary side view of a rail anchor of the hook jaw type made from a bar in which the neutral axis lies near the inner bend of the hook;

Fig. 6 is an end view of the structure shown in Fig. 5, illustrating the tendency of the vertical web thereof to bow laterally along line 6—6 of Fig. 5 when the upper jaw of the anchor is flexed upwardly relative to the body.

The anchor device herein shown is of a known general type and may be described briefly as comprising a metal bar formed at one end with an open elongated loop in the form of a hook which provides the anchor with upper and lower jaws 10 and 11 adapted to grip the top and bottom surfaces, respectively, of one base flange 12 of a railroad rail 13. The jaw portion 11 of the anchor device is extended across the bottom sur-

face of the rail and constitutes the body portion of the anchor. The said body portion is formed at its outer end with an up-pressed shoulder **15** which engages over the lower corner portion of the rail base flange **16** so as to lock the anchor device on the rail. The hooked portion of the anchor is formed so that the upper jaw **10** will have such configuration that it will bear on the inclined top surface of the rail base flange **12** only at a location spaced inwardly from the longitudinal edge of the rail and so that the inner curved surface **17** of the hook will be spaced outwardly from the edge of the base flange. The curved inner surface **17** is also formed to provide a clearance **18** between the anchor device and the lower corner of the rail base flange **12**.

When the anchor herein shown is driven to its applied position on the rail, the upper jaw **10** is sprung outwardly from the lower jaw **11**. Consequently, the resilient force exerted by the upper jaw on the top surface of the rail base and the pressure exerted by the lower jaw **11** against the bottom surface of the rail at the fulcrum point **19** tends to turn the anchor about said bearing **19** as a fulcrum to press the body of the anchor firmly against the bottom surface of the rail and to hold the shoulder **15** in its locking position.

The metal is so distributed in the present anchor device that the section modulus (the index of strength of a bar) of the portion adjacent the rail engaging platform and the inner perimeter of the hook is greater than the section modulus for that portion of the anchor lying between the neutral axis of the bar and the outer curved surface of the hook, but the neutral axis (NA) of the improved bar lies relatively close to the middle line of the section, whereas the neutral axis (NA) of the T-shape bar, as compared with the new form of bar in Fig. 4, lies relatively close to the tension side of the bar (Figs. 4 and 5).

It will be observed by inspection of Fig. 4 that the physical properties of the new form of bar are substantially balanced above and below the middle line of the bar, whereas the distribution of metal in the T-shaped bar section of corresponding area is very much unbalanced. The physical properties of the bar, it will be understood as matters of terminology are "area" (A), the "moment of inertia" (I), and the "static moment" (S). The area, of course, is the cross sectional area of the bar. The "moment of inertia" (I) is the sum of the products obtained by multiplying each element of the area by the square of its distance from the axis. The "static moment" (S) is the sum of the products obtained by multiplying each element of the area by its distance from the axis. Computations of these physical properties of the improved bar are compared herein with corresponding computations of a T-bar section of identical area as follows:

NEW BAR SECTION

	Moment of Inertia (I)	Static Moment	Area (A)	I/S Ratio	S/A Ratio
Above Middle	.21875	.31031	.52500	.70494	.59107
Below Middle	.12285	.18313	.35000	.67083	.52323

T-SECTION OF EQUAL AREA

Above Middle	.31250	.40828	.61600	.76541	.66279
Below Middle	.07957	.12375	.25900	.64299	.47780

It will be observed by comparing the I/S and S/A ratios of the cross-section of the present anchor device with the corresponding ratios of other known sections of corresponding area heretofore used, for example, the T-section shown in Fig. 4, that the present anchor includes a more economical distribution of the metal in that it provides adequate strength, by virtue of the enlarged portion **20**, forming a rail engaging platform of the anchor, and the tie abutting portion **21**, to resist the tension and compressive forces exerted on the hook portion of the anchor, and also makes it practicable to form the tie abutting portion **21** with sufficient thickness to prevent distortion when it is subjected to the creeping force of the rail. It will be observed, in this connection, that the large fillet **20***a* at the junction of the portions **20** and **21** adds to the tension resisting function of the enlarged portion **20** and also adds rigidity to the tie abutting portion **21**.

It will also be observed that the specific distribution of metal, as disclosed by the present invention, provides the anchor body with spaced upper and lower chords and an intervening vertical web, the upper chord including the enlargement **20** and the said fillet **20***a* to place a preponderance of metal in the body above the middle line thereof and in the zone of maximum tension imposed on the said upper chord along the inner perimeter of the hook. The radius of the fillet **20***a* is preferably tangent at one end to the lower portion of the upper chord and also tangent at the other end with the intervening web substantially at the neutral axis. The special metal distribution herein shown makes it practicable to form the rail base gripping surface **22** of less width than it has been used heretofore (see Fig. 4) and thereby provides a substantial increase in the torsional grip of the anchor on the rail when the tie abutting portion is pressed against the tie.

Full advantage of the said tortional gripping action of the anchor on the rail is made possible in the present invention by virtue of the increased rigidity imparted to the upper jaw by the relatively heavy portion **26** of the tie engaging flange which extends around the hooked end of the anchor and overlies the upper jaw **10** at a location directly above the edge **23**, as shown in Fig. 3. It will be observed that the tortional strain as applied to the forward edge **24** of the lower jaw **11** is distributed throughout the full length of the body portion **14** of the anchor. Consequently, there is not much likelihood of this strain imparting distortion to the body portion of the anchor which lies beneath the rail base. However, the said tortional strains are concentrated on a relatively small area of the upper jaw **10** along the rail edge **23** thereof and therefore increases the tendency to flex the upper jaw **10** outwardly from the anchor body. However, the increased strength provided by the relatively heavy portion **25** of the tie abutting portion which extends around the hook and overlies the upper jaw, provides effective resistance to the tortional strains imposed on said upper jaw along the edge **23** thereof.

The enlargement **26** which extends along the outer surface of the hook shaped bend (Figs. 1 and 2) provides a thick body of metal, as distinguished from the thin flange **27** of the T-section shown in Fig. 4, to receive the impact force of a sledge or other applying implement which may be used to drive the hooked portion of the anchor onto the base flange **12**. It will be observed also that the neutral axis B (Fig. 4) of the improved bar section lies relatively close to the middle line

as distinguished from the neutral axis C (Fig. 4) of the T-section. Consequently, the tension and compression forces are substantially balanced throughout the full vertical width of the bar and thereby avoids lateral deflection or bowing of the web when the upper jaw 10 is flexed outwardly during the application of the anchor to a rail or during the presence of severe tortional strains on said jaw. In other words lateral bowing of the web as shown at D in Fig. 6 in connection with a T-section anchor, is not present in the improved anchor.

I claim:

1. A rail anchor comprising a geometrically unsymmetrical bar having a horizontal body portion formed along its upper edge with a flat rail engaging platform and extending across the rail beneath the base thereof and bent at one end into hook form to provide a resilient open loop elongated lengthwise of the bar and providing upper and lower jaws for gripping the top and bottom surfaces, respectively, of one base flange of the rail and formed at the other end with locking means for engaging the rail base flange at the other side of the rail, the anchor device being further characterized in that the metal is so distributed relative to the middle line of the transverse cross-section and the neutral axis extending longitudinally of the bar so that the said rail engaging platform is in the form of a thick flange projecting laterally from a vertical flange and extending around the inner perimeter of the hook and provides the major portion of the metal lying on the tension side of the bar at the bend, there being a fillet at the junction of the lateral flange with one side face of the vertical flange, which fillet extends from the horizontal flange to substantially the said neutral axis of the bar, the other side face of the flange being flat to provide a tie abutting face of large area and the lower marginal portion of the vertical flange being provided with a lateral reinforcing rib to resist lateral distortion of the vertical flange and contributes to a cross-sectional configuration in which the section modulus for that portion of the hook lying on the tension side of the said middle line is substantially greater than the section modulus of the portion lying on the compression side of said middle line.

2. A rail anchor constructed according to claim 1 and further characterized in that the distribution of metal is such that the I/S and S/A ratios are in substantial balance for opposite sides of the middle line of the bar section.

3. A rail anchor constructed according to claim 2 and further characterized in that the said lateral reinforcing rib extends along the outer perimeter of the hook and provides an outer surface of large area for receiving the impact force of an applying sledge, and is substantially wider than the thickness of the bar at said middle line.

4. A one-piece rail anchor of the type having a hook at one end and including a body wherein the metal is distributed with reference to the transverse middle line of the cross-section and the neutral axis extending lengthwise of the bar so as to provide a flat tie engaging face at one side and upper and lower chord members separated by an intervening web face on the other side, said upper chord member connected with said web face by a fillet whose lower end joins said web face substantially at the neutral axis of the body to provide a preponderance of metal in the body above the middle line thereof and in the zone of maximum tension imposed on the upper portion of the body including the hook.

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