Nov. 25, 1952 S. G. THOMSON 2,619,290

RAIL JOINT FOR V HEAD RAIL TYPE

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Fig. 1.

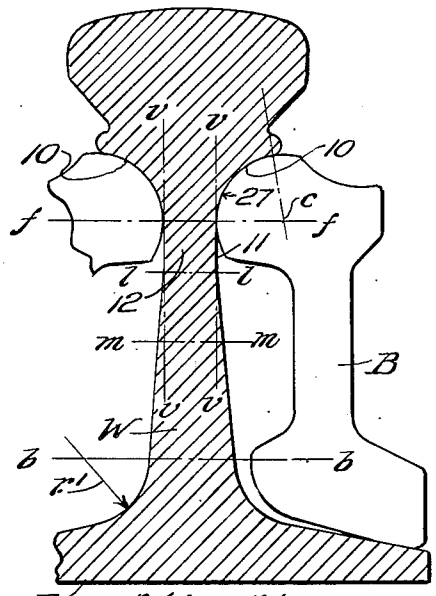


Fig. 2.

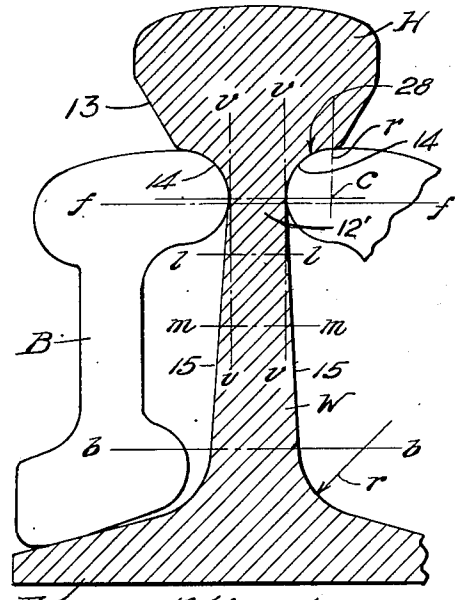


Fig. 3.

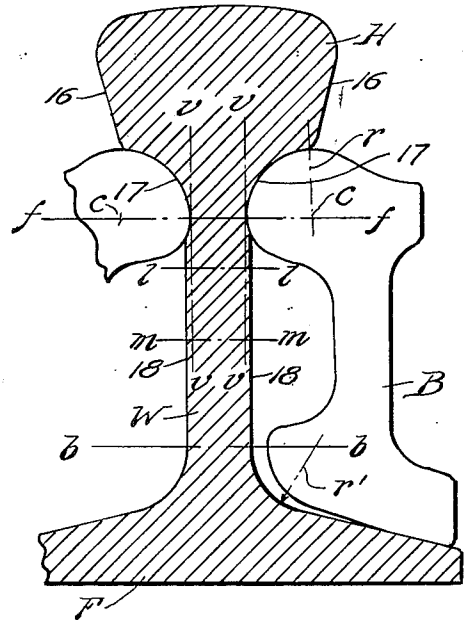
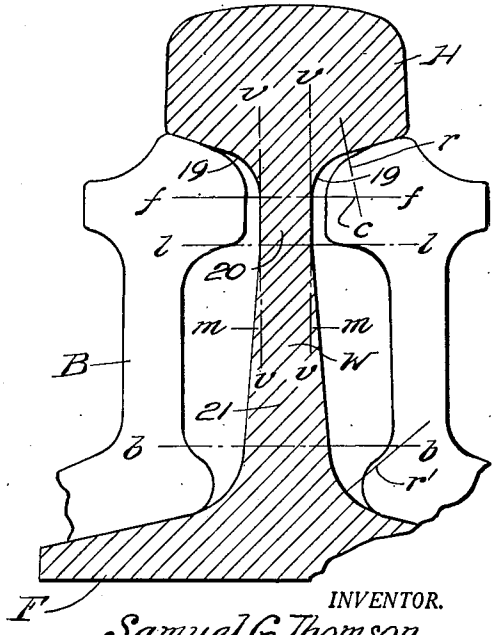


Fig. 4.



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Fig. 5.

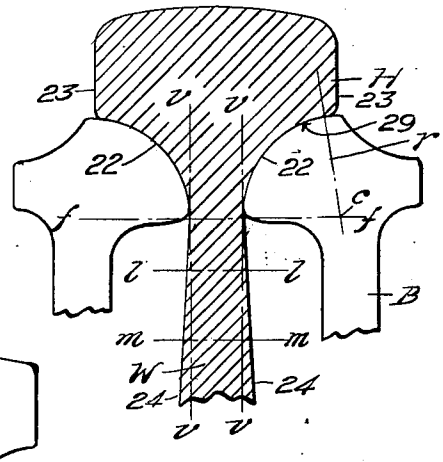


Fig. 6.

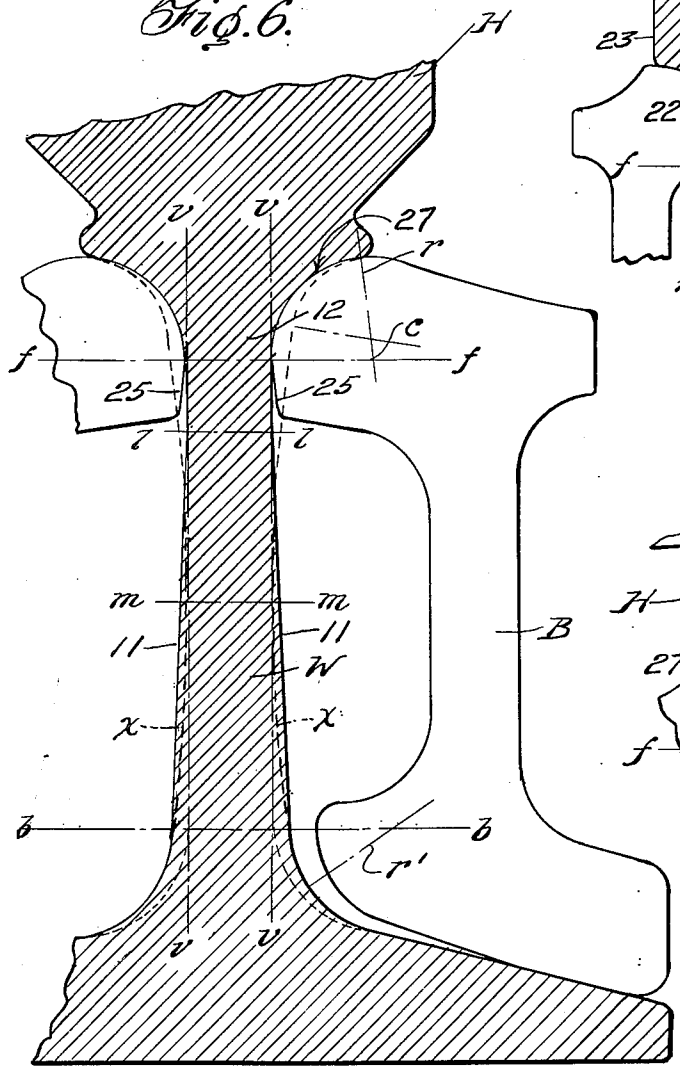
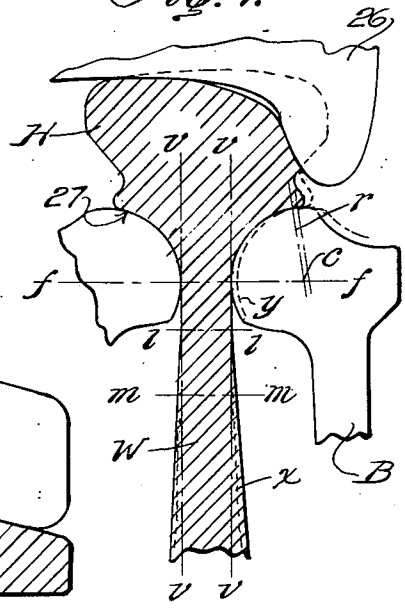


Fig. 7.



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Fig. 8.

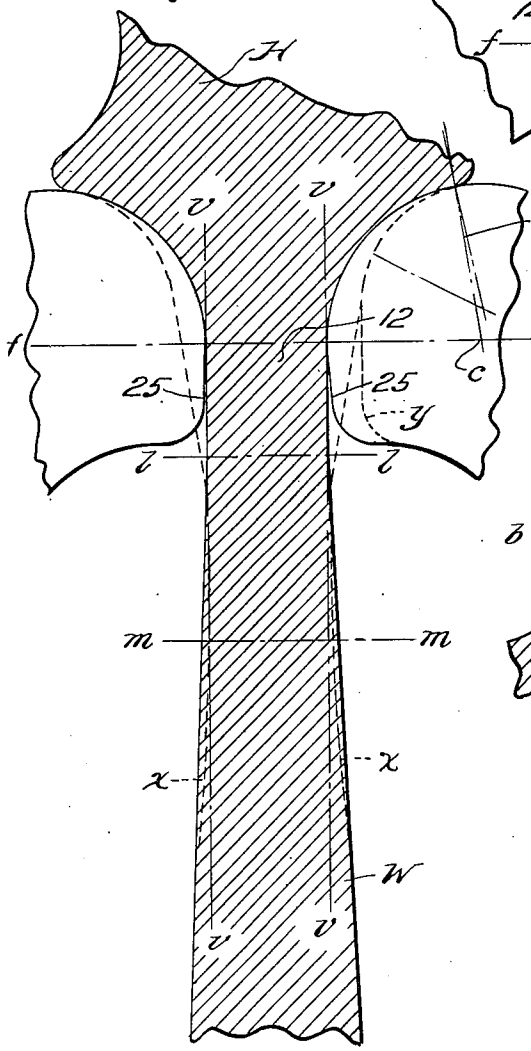
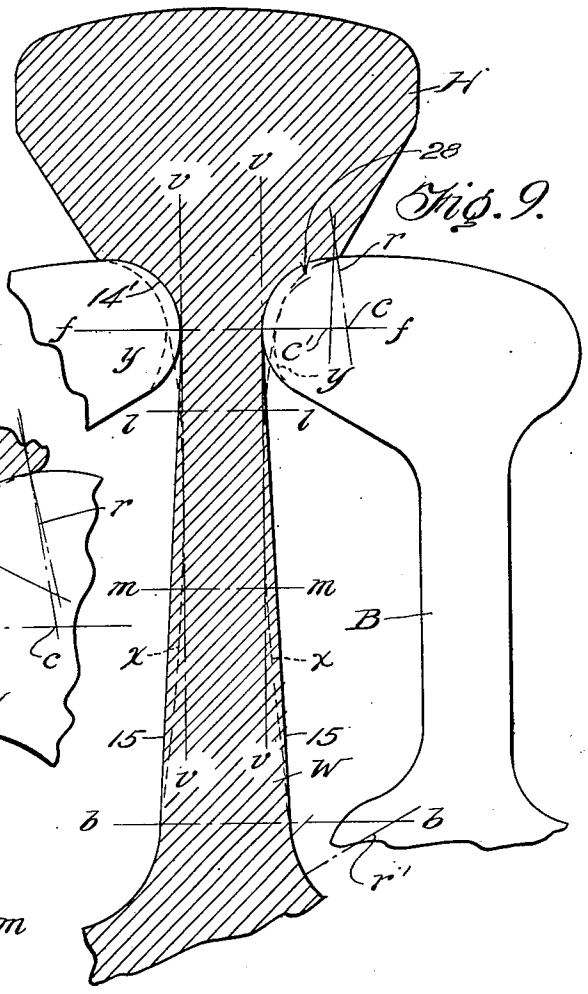


Fig. 9.



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Fig. 11.

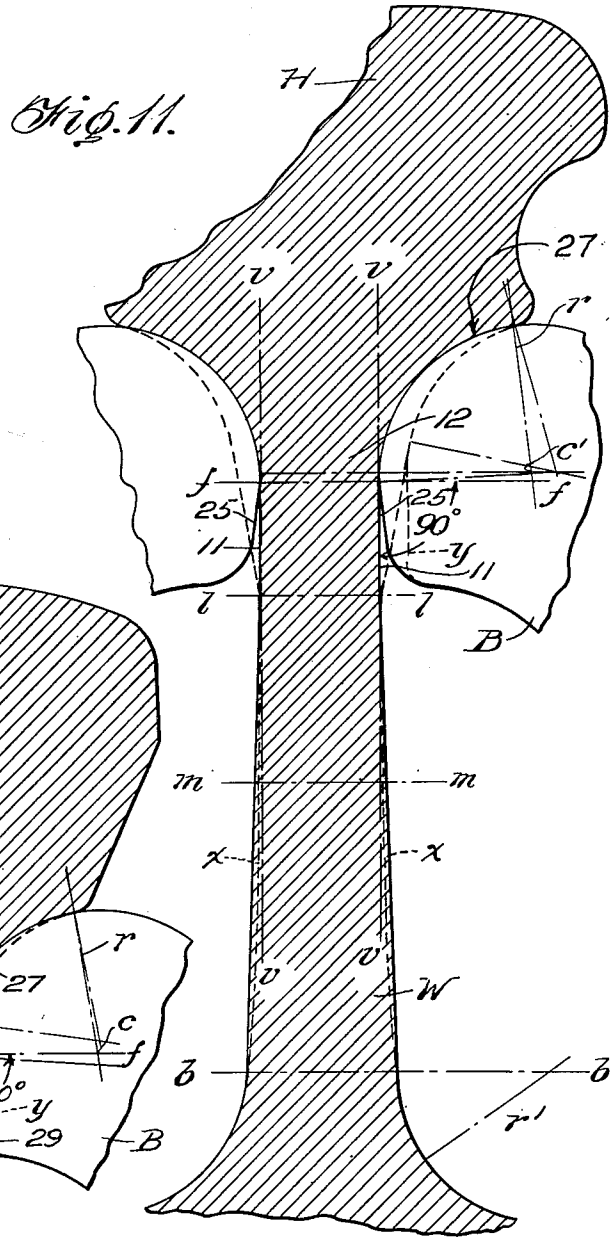
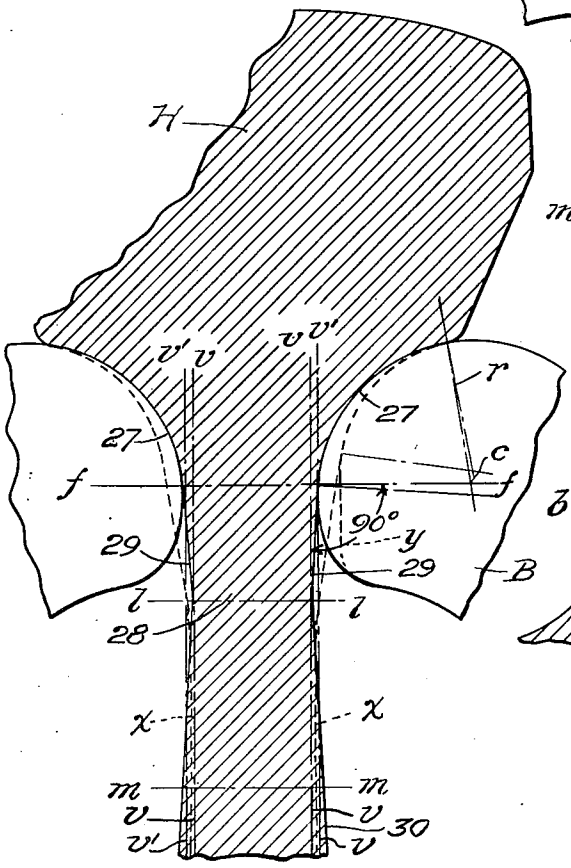


Fig. 10.



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2,619,290

UNITED STATES PATENT OFFICE

2,619,290

RAIL JOINT FOR V-HEAD RAIL TYPE

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Continuation of application Serial No. 451,170, July 16, 1942. Division of application Serial No. 439,755, April 20, 1942. This application November 27, 1946, Serial No. 712,519

9 Claims. (Cl. 238—125)

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This invention relates to rail joints and has special reference to a joint for rails of the type known as V-head rails. This application is a continuation in part of my application filed July 16, 1942, Ser. No. 451,170, now abandoned, Rail Joint for V-Head Rail Type. More particularly the invention relates to joints for rails such as are shown and described in my co-pending application filed Apr. 20, 1942, Ser. No. 439,755, now abandoned, of which the present application is a division.

The advantages of the rails described in said copending application have been fully discussed therein and will not be discussed in the present application.

One important object of the present invention is to provide for the widening of the bearings for the joint bars under the rail head, thus not only reducing rail and joint bar wear at these points, but also obtaining adequate bearing surfaces under the rail head hitherto lacking and thus reducing maintenance costs.

A second important object of this invention is to widen the upper head bearing of the joint bar or splice bar by extending it into the space vacated by removal of metal from the usual web section in accordance with my improved rail design and to obtain thereby extreme width of bearing which greatly reduces wear and breakage, increases the life of the bar and makes it unnecessary to remove the bar for build-up or reforging.

A third important object of the invention is to improve the self-adjusting fit of the bar to rail bearings where the tolerances of bar and rail are wide by the inward extension of its bearing engagement with the rail.

A fourth important object of the invention is to increase the stiffness and strength of the bar by adding metal to the width of its head at its widest portion and at a great distance from its horizontal neutral axis thereby increasing the moment of inertia which is directly proportional to its stiffness, and increasing the section modulus above the neutral axis, which is usually deficient when balanced against the section modulus of the lower portion in a well designed bar.

A fifth important object is to allow the head of the joint bar to set in further under the rail head so that its top clears an excessively worn wheel flange for a longer time as the top of rail head is worn down and its side worn off when located on the high side of curves.

In the accompanying drawings like characters of reference indicate like parts in the several views, and:

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Figure 1 is a fragmentary cross-section of one form of the improved rail and a splice bar arrangement associated therewith, the rail being of a type termed a flangefree V-head rail.

Figure 2 is a fragmentary view similar to Figure 1 showing a rail and splice bar with the rail of a headfree V-head type.

Figure 3 is a view similar to Figure 2 but showing a modified form of rail.

Figure 4 is a fragmentary cross-section of a rail and splice bar arrangement disclosing a standard contour of rail head associated with the improved web section forming an important feature of this invention.

Figure 5 is a view similar to Figure 4 but showing the fillets beneath the rail head modified to form a hybrid V-head, the remainder of the head contour being standard.

Figure 6 is a fragmentary cross-section of a V-head rail and a splice bar arrangement slightly modified from the showing in Figure 1.

Figure 7 is a fragmentary cross-section showing the effect of wear on the head form shown in Figure 1.

Figure 8 is a fragmentary cross-section showing a further modification of the disclosure of Figure 1.

Figure 9 is a fragmentary cross-section showing a further modification of the disclosure of Figure 2.

Figure 10 is a fragmentary cross-section showing a still further modification of the disclosure of Figure 2.

Figure 11 is a fragmentary cross-section showing a modification of the form shown in Figure 1.

In order to illustrate the identity in principle of the several forms of the invention herein disclosed reference will be had to certain lines and zones common to all forms. Of these lines the two lines V—V, V—V are traces of vertical parallel planes defining the narrowest portion of the web section and the line *f—f* indicates the trace of a horizontal plane passing through the upper limit of the rail web where it merges into the fillets below the head of the rail. At a distance below the line *f—f* substantially equal to the distance between the lines V—V and V—V is a line *l—l* indicating the lower limit of the thin part of the web and a line *m—m* indicates the horizontal midline of the height of the web between the upper and lower fillet arcs. Finally, the line *b—b* is the trace of a horizontal plane at the upper limit of the rail base or flange fillet arcs, the line *m—m* being equidistant from the lines *f—f* and

b—b. The head fillets are indicated as having radii r while the base fillets have radii r'.

With the foregoing lines in mind the various modifications of the invention will now be described. It is first to be noted that the side surfaces of each rail web are formed as plane surfaces although curved surfaces may be substituted and that in each form these surfaces diverge downwardly below the line l—l with the single exception of the form shown in Figure 3. In the various views there is indicated in general a rail having a head H, a web W and a base or flanged foot F. In connection with the rails the splice bars are indicated in general at B.

In Figure 1 it will be seen that the head H has the lower ends of the concave arcs 10, forming the fillets of the head, tangent to the lines V—V and extending flaringly upward to an extent of nearly 90° on each side. These fillets merge into the upper side faces of the web W and these faces 11 between the lines f—f and l—l are parallel to lie in the planes V—V. There is thus a narrow zone 12 of uniform thickness at the top of the web below which the web increases gradually and uniformly in thickness to the line b—b. It will also be noted that the head of the splice bar B contacts throughout the arc 10 and this curve continues on the splice bar head so that the web W is free from the splice bar head below the line f—f. Moreover, the radii r in this form are of such length that the outer ends of the arcs 10 are spaced approximately three-fourths the width of the head H.

It will thus be apparent that the head portion of the joint or splice bar has a broad bearing against the under side of the rail head and this bearing adds both vertical and horizontal support to the rail head.

In the form shown in Figure 2 the lower portions 13 of the sides of the head H converge downwardly to the outer ends of fillet arcs 14 which merge at their lower ends into the flat downwardly flaring upper sides 12' of the narrow zone; said sides being in alignment with lower sides 15 of the web which increases in thickness at a uniform rate from the line f—f to the line b—b.

In Figure 3 the head H has downwardly converging side faces 16 from the lower ends of which extend the fillet arcs 17 struck from centers C on the line f—f so as to form arcs tangent to the lines V—V and V—V. In this form the major portion of the web has parallel sides 18 spaced to a greater distance than the lines V—V so that the arcs 17 continue below the plane f—f to intersect the side planes 18. The head of the splice bar B, in this form, contacts the arc 17 throughout its extent in section. Thus in both this form and the form shown in Figure 2 there is provided, by the broad head bearing of the splice bar, both vertical and horizontal support for the rail head.

In the form shown in Figure 4 there is shown a head H having a standard contour so far as the tread and side faces are concerned but the under side of the head is provided with fillet arcs 19 tangent to the lines V—V and V—V and merging into the side faces of the web W. This web has the same form as that in Figure 1, having a parallel sided upper zone 20 and a divergingly sided lower zone 21. In this form while the splice bar head is not shown as actually contacting the upper part of the rail web, yet the width of the engagement of the splice bar head and its particular disposition beneath the rail head is such that the bars add to the vertical support of the rail head and also support said rail head against lateral stresses.

In Figure 5 there is shown a modification of the form of Figure 4. Here again the rail head H has its tread and sides of standard contour but the under fillet arcs 22 extend from the side faces 23 of the head inwardly and downwardly to points of tangency to the lines v—v and v'—v' and the downwardly diverging sides 12' of the narrow zone which are in downward alignment with the sides 24 of web W. Here the splice bar head contacts the under side of the rail head from the narrowest part of the web to the extreme outer face of the rail head thus giving great addition to resistance against vertical and lateral stresses exerted on the rail head.

In the form shown in Figure 6 the rail is substantially a modification of that shown in Figure 1 but the head of the splice bar B has a flat face 25 extending downwardly and inclined outwardly from the web sides 11. This flat face arrangement does not, however, detract from the broad and close bearing of the splice bar head beneath the rail head and the arrangement is highly efficient in resisting vertical and lateral stresses on the rail head.

In Figure 7 a flangefree design, same as Figure 1 is shown in badly worn condition in combination with a wheel with a worn flange and tread, a portion of which is shown at 26. Due to the feature of this invention comprising the moving inward of the under corner of the rail head away from the wheel flange, the rail and joint bar are kept in service longer before the wheel flange grinds solidly to its tip into the rail head.

Figure 8 shows a form in which the rail is a modification of that shown in Figure 1 and the splice bar B like that of Figure 6.

Figure 9 shows a form similar to Figure 2 but having a relatively shorter radius r for the arcs 14'.

Figure 10 shows a form of rail web wherein the thinnest part of the web is on the line l—l and v—v. The fillet arcs 27 are tangent to upwardly diverging sides 29 of the narrowed or restricted web-thickness zone lying between lines f—f and l—l.

The lines v'—v' represent vertical planes at the innermost face of arcs 27 and at the widest portion of the reduced web zone, which planes extend downward to intersect and to lie inside of a portion of upright web face 30 above m—m. Because of this the upper narrow zone 12 of the web has upwardly diverging sides 29 while the remainder of web has downwardly diverging sides 30.

Figure 11 shows a form much like that of Figure 6 but here the centers C' of the radii r lie above the line f—f and not on that line as in Figure 6.

In the forms shown in Figures 8, 9, 10 and 11 the same arrangement of broad and highly stress-resisting contact exists between the splice bar head and the under side of the rail head.

It will now be plain that the section of the web is such that the point of greatest stress under lateral load is in all cases the thickest part of the web proper and the point of least stress under such load is close to the point of application of the load against the head H.

It will also be plain that because the web is thinner than in the usual rail forms immediately below the rail head the splice bar head is afforded much greater bearing surface beneath the head than is possible with usual rail forms. Thus the broad contacting surfaces keep the unit

stresses between the rail head and splice bar head so low as to greatly lessen wear and the need for repairs and replacement.

It will be noted regarding the upper narrow portion of web referred to above, that the exact narrowest point can be at or adjacent the top or at the bottom limit of this upper portion having a substantially square vertical section; or the narrowest part of web may comprise the entire height of this zone, thus having its upright sides vertical and parallel as indicated by 12 in Figures 1, 4, 6, 7, 8. The upright sides of this narrow portion also may extend flaringly downward in alignment with the diverging sides of web as indicated by 12' in Figures 2, 5 and 9; or said sides may diverge upwardly as indicated by 29 in Figure 10. This variation in web thickness within this narrow upper zone is slightly exaggerated in the drawings for purpose of better illustration, but in actual practice is almost negligible and therefore has very little effect in the amount of metal removed from the web sides or in the inward shift of the fillet arcs which in turn vitally affects the shape of the V-head of the rail and widens the bearings for joint bars.

Two principles in rail-head design are used in taking advantage of the space vacated by web metal; First, the use of a fillet arc larger than the usual design with its radius-centre lying the same distance outside the under corner of the rail head as does the centre of usual design, as shown in Figures 6, 8, 10, thus affording a wider bearing for the joint bar. In other words, the space occupied by material removed from the upper web metal (a basic feature of the invention) is shown in Figures 6, 8 and 10 between the section-lined rail and the dotted *d* lines defining the standard rail. This space is used to advantage to widen the curved bearing face and also to widen the bar head. This is effected by enlarging the standard radius (shown dotted) and at the same time keeping the centre of the enlarged radius in the same vertical plane as the centre of the smaller standard radius; that is: at substantially the same distance outward from the rail web, and likewise outward from the under corner of the rail head. Second, the use of a fillet arc the same as the usual design with its radius-centre moved further inward under the corner of rail head than the usual design, thus permitting the upper outer edge of the arc to be carried around closer to a horizontal plane as shown in Figures 7, 9, 11. This is an effective improvement in holding the joint bar in at the top.

Furthermore, the following is to be particularly noted. In Figures 6 to 11 inclusive the relationship of the present form of rail cross-section to the usual or previous forms is clearly indicated. In these figures the contour of the usual web sides is shown by the dotted lines *x* and the splice bar contour necessitated by the usual rail form is shown by the dotted lines *y*. When these dotted line contours are compared with the full line contours of the present disclosure it will be seen that the better distribution of metal in the cross-section is obtained without adding weight to the rail or increasing the area of the cross-section.

In contrast with the rectangular T-head rail (Fig. 4) now in general use, there are two types of V-head rail which differ in respect to the ratio of the two portions which are joined to form the entire downwardly and inwardly slanting sides of the V—the curved bearing portion and the upper flat portion which slants inwardly to join the curved portion. In the "flangefree" type, the curved bearing 27 forms at least one-half of the entire slanting side of the V, shown in Figures 1, 6, 7, 10 and 11; while in the "headfree" type, the curved bearing 28 forms scarcely one-third, shown dotted as usual (headfree) not (improved headfree) in Figure 9. In Figure 5, a "hybrid" type of V-head is shown, formed from the standard T-head (Figure 4). In this design the curved bearing 29 forms the entire side of the V portion of the rail head. In the preferred forms (flangefree), it is obvious that, in referring to the fillet zone of the rail section, the description "bearing" is more fitting, since there is no abrupt corner or fillet to fill in the V-head rail. It also is obvious with respect to the new section that, with the elimination of the fillet and abrupt change of section, the thickening of the web as it approaches the head is no longer necessary, and that this extra metal can be reclaimed to be used elsewhere in the section at a much greater distance from the horizontal neutral axis. The enlarged fillet or bearing for joint bar of the "flangefree" section is a much more scientific way for easing abrupt change in section than increased web thickness.

The novel and characteristic section of the V-head rail in its preferred flangefree forms is obtained by adding extra width and depth to the joint bar bearing or fillet zone of the rail sections shown and described in the patent to W. P. Thomson No. 1,507,870 of Sept. 9, 1924; and especially in my own prior Patent No. 1,806,426 of May 19, 1931; and in McLeod Thomson No. 2,257,027 of Sept. 23, 1941.

The reduction of web thickness of the usual section at the part 12 adjacent the lower edge of the head fillet is the keypoint in the new V-head design. This is the factor as well as the point in the section which defines the lateral position of the fillet or joint bearing arc, whether the radius of the arc be large or small relative to the over-all width of the rail head.

Two other factors in the formation of the V-head are: The size of bearing arc and the location of its upper outer edge relative to the upright side face of the head. This determines the width, depth and consequent inclined angle of the V portion or zone of the head, and also determines the ratio of curved bearing width to the over-all width of the head. The second factor is the location of the radius-centre relative to the top of head and to a vertical plane defining its width. This determines the general shape of the entire head and the weight of metal desired within the V-head contour.

Still another important factor in the V-head development, tending rather to the headfree contour, is the setting inward of the relatively small joint bar bearing by the reduction of the adjacent web thickness, (Figure 9). This adds a substantial percentage to the width of a relative small bearing which has been found to be inadequate, without changing the location of the under corner anchorage of the head for the joint bar and without increasing the radius of the bearing. It also permits the upper outer edge of the bearing to be carried around closer to a horizontal plane. This gives greatly increased assistance in holding the bar in at the top, which, with the extra width provided by moving the radius-centre inward, provides a

relatively small bearing with greatly improved efficiency.

What is claimed is:

1. In a rail-joint, a railroad rail having a V-head, and an upright web joined thereto, said head having side faces with upright upper portions, said head having underlying side portions each extending from the lower edge of the respective upper portion to a point on the surface of the side of said web the lower portion of each underlying side including a curved surface extending inwardly from the lower edges of the upright side faces of said head, and a pivoting-type joint-bar having curved bearing engagement with said curved surface, said bearing engagement having not less than half of the horizontal extent of the full outward projection of said entire underlying side, said engagement extending inwardly to a vertical plane lying inward of a point in said web side midway of the web height.

2. In a rail-joint, a railroad rail having a V-head, and an upright web joined thereto, said head having side faces with upright upper portions, said head having underlying side portions each extending from the lower edge of the respective upper portion to a point on the surface of the side of said web the lower portion of each underlying side face including a curved surface extending inwardly from the lower edges of the upright side faces of said head, and pivoting-type joint-bars each engaging a respective curved surface, each said curved surface extending inwardly to a vertical plane lying inward of a point in said web side midway of the web height.

3. In a rail-joint, a railroad rail having a V-head, and an upright web joined thereto, said web having an uppermost zone provided with upright sides, said head having underlying oppositely disposed curved surfaces joined to the upright sides of said uppermost zone of the web, and joint-bars each making curved engagement with a respective curved surface adjacent the upper limit of said web zone, the web thickness at any elevation within said zone being less than the web thickness midway of the web height, said zone extending below the symmetrical lower limits of said curved engagement of the joint bars a distance not substantially exceeding the greatest web thickness within said zone, each of said curved surfaces having a horizontal extent greater than half of the full projection of the upper outermost face of said head outwardly from a vertical plane at the innermost limit of said curved surface.

4. In a rail-joint, a railroad rail having a V-head and an upright web joined thereto, said web having an uppermost zone provided with upright sides, said head having underlying curved surfaces each joined to the upright side of said uppermost zone of the web, and joint-bars each making curved engagement with a respective curved surface, said zone including sections less in web thickness than any web thickness underlying said zone, the zone extending below the lower limit of said curved engagement a distance not substantially exceeding the greatest web thickness within said zone, said curved surface extending inwardly to a vertical plane lying inward of a point in said web side midway of the web height, the outer limit of said curved surface lying nearer to a vertical plane at the upper outermost upright face of said head than to said inner vertical plane.

5. In a rail-joint, a railroad rail having a V-head and an upright web joined to said head, said web having an uppermost zone provided with upright sides, said head having an underlying curved surface extending from the lower edge of the respective upright side of the head to join the upright side of said uppermost zone of the web, and joint-bars each making curved engagement with a respective curved surface, said zone having its greatest transverse thickness less than the web thickness at a point midway of the web height, the zone extending below the lower limit of said curved engagement a distance not substantially exceeding the greatest thickness within said zone, said curved engagement extending inwardly to a vertical plane lying inward of a point in said web side midway of the web height, the outer limit of said curved engagement lying nearer to a vertical plane at the upper outermost upright face of said head than to said inner vertical plane.

6. In a rail-joint, a railroad rail having a V-head, and upright web joined thereto, said web having an uppermost zone provided with upright sides, said head having underlying curved surfaces one each of which is joined to a respective upright side of said uppermost zone of the web, and joint-bars each engaging a respective said curved surface adjacent said juncture, the lower limit of said engagement being adjacent the upper limit of said zone of web, the greatest web thickness within said zone being less than any web thickness underlying said zone, the zone extending below its said upper limit a distance not substantially exceeding said greatest thickness within the zone, the upper limit of said engagement being nearer to a vertical plane at the upper outermost upright face of the rail head than to a vertical plane at the inner limit of said engagement.

7. In a rail-joint, a railroad rail having a V-head and an upright web to which said head is joined, said web having an uppermost zone provided with upright sides, said head having underlying curved surfaces each of which is joined to a respective upright side of said uppermost zone of web, and joint-bars each having a head making curved engagement with a respective one of said curved surfaces, the joint-bar head being positioned so that a horizontal plane at the upper limit of said web zone lies adjacent a horizontal zone of greatest width of said joint-bar head, the greatest web thickness within said web zone being less than the web thickness midway of the web height, the web zone extending below said horizontal plane a distance not substantially exceeding said greatest web thickness, said curved surface of head engaged by the joint-bar head extending inwardly to a vertical plane lying inward of a point in said web side midway of the web height.

8. In a rail-joint, a railroad rail having a V-head and an upright web joined to said head having side faces with upright upper portions, said head having underlying side portions each extending from the lower part of the respective upper portion to a point on the surface of the corresponding side of said web, the lower portion of each underlying side portion including a curved surface extending inwardly from the lower edge of the respective upright side face of said head, and pivoting type joint bars each having curved bearing engagement with a respective curved surface, said bearing engagements each extending inwardly to a vertical plane lying inward of a

point in the respective web side midway of the web height.

9. In a rail-joint, a railroad rail having a V-head and an upright web joined to said head, said head having side faces with upright upper portions, said head having underlying side portions each extending from the lower part of the respective upper portion to a point on the corresponding surface of said web, the lower portion of each underlying side portion including a curved surface extending inwardly from the lower edge of the respective upright side of said head, and pivoting-type joint-bars each engaging a respective curved surface, said curved surfaces each joining a respective upright side of the web at a vertical plane lying inward of a point in said web side midway of the web height, the radius-center of each said curved surface being nearer to a vertical plane at a respective outermost upright face than to the adjacent first mentioned inned vertical plane.

SAMUEL G. THOMSON.

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