June 8, 1948. B. B. McCARN 2,442,774

INTEGRAL TROLLEY RAIL

Filed Oct. 19, 1944 3 Sheets-Sheet 1

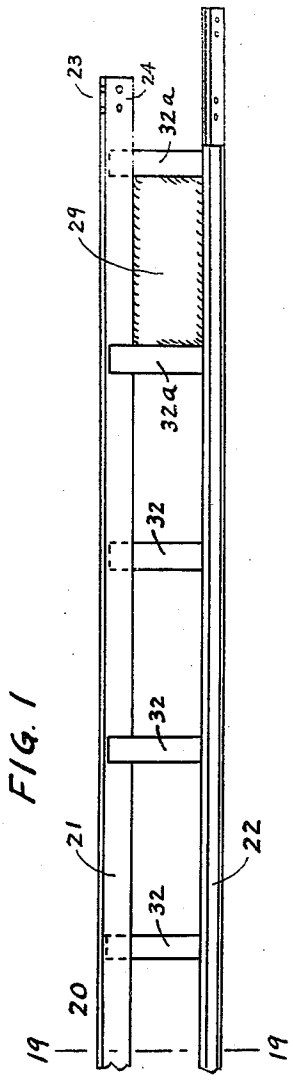


FIG. 1

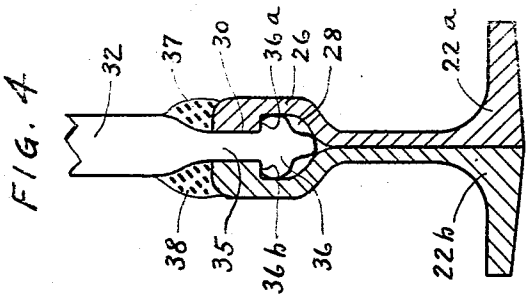


FIG. 4

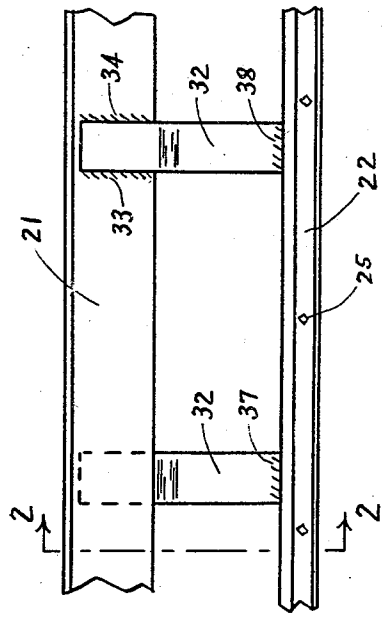


FIG. 3

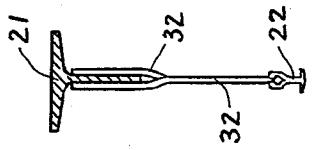


FIG. 2

Burtis B. McCarn INVENTOR.

June 8, 1948. B. B. McCARN 2,442,774

INTEGRAL TROLLEY RAIL

Filed Oct. 19, 1944

3 Sheets-Sheet 2

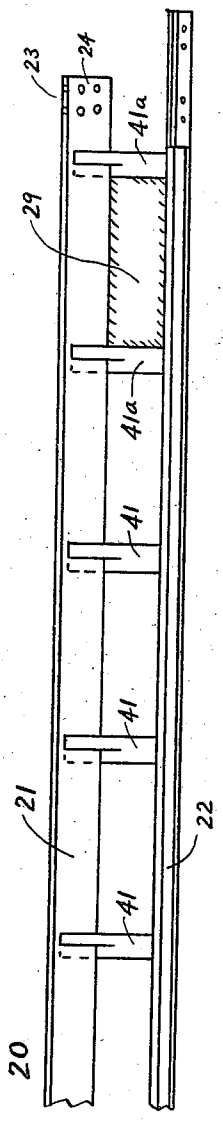


FIG. 5

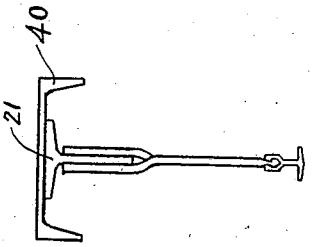


FIG. 8

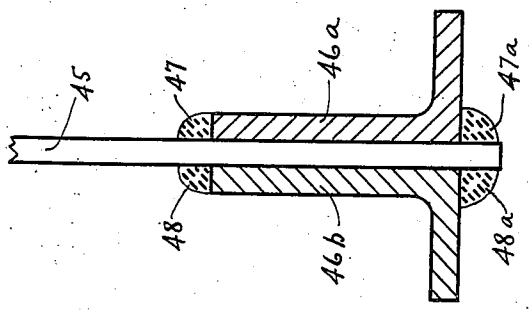


FIG. 7

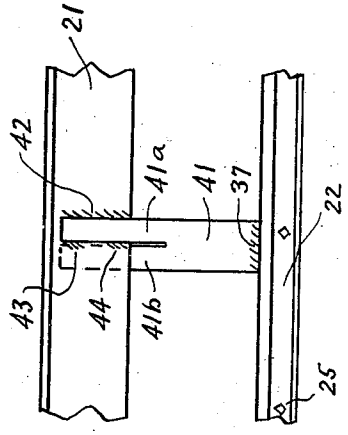


FIG. 6

Burtis B. McCarn INVENTOR.

June 8, 1948. B. B. McCARN 2,442,774

INTEGRAL TROLLEY RAIL

Filed Oct. 19, 1944 3 Sheets-Sheet 3

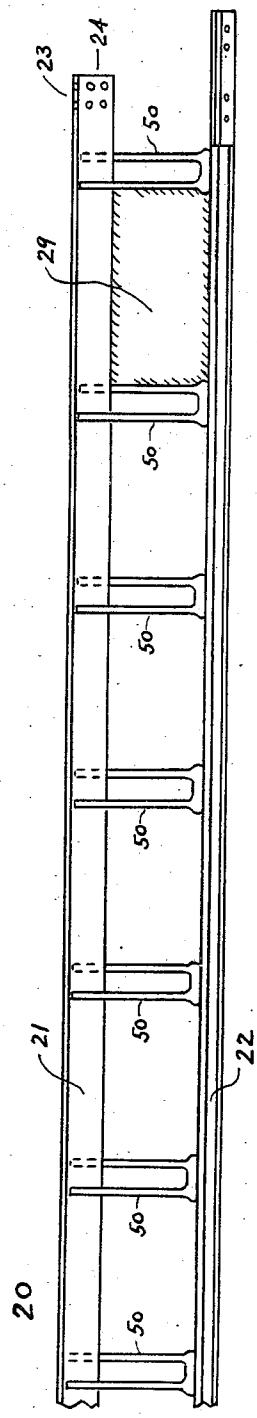


FIG. 9

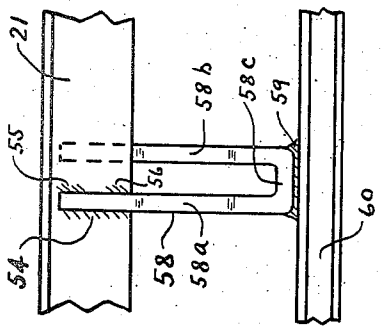


FIG. 12

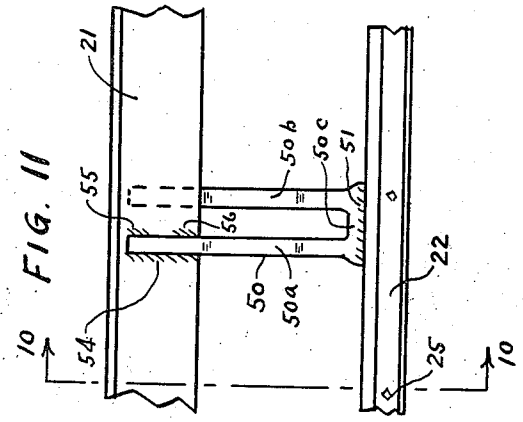


FIG. 11

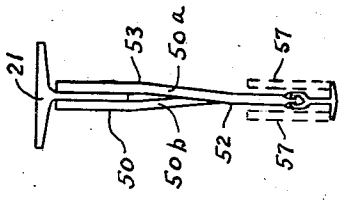


FIG. 10

Burtis B. McCarn INVENTOR.

Patented June 8, 1948

2,442,774

UNITED STATES PATENT OFFICE

2,442,774

INTEGRAL TROLLEY RAIL

Burtis B. McCarn, Jersey City, N. J.

Application October 19, 1944, Serial No. 559,339

21 Claims. (Cl. 104—111)

1

This invention relates to improvements in overhead trolley rails and more particularly to trolley rails comprising as a new article of manufacture an integral assembly of lower chord of standard trolley track and an upper chord of structural section connected by a plurality of chord-joiners of novel style and having novel relationships with the respective chords. This invention also discloses a novel combination of parts for economically resisting the various external and internal stresses of an integral rail.

The general requirements for a two-thread integral trolley rail are well known. It has the design requirements of a beam for carrying a moving load, characterized by having the load applied to the bottom chord and suspended below it, by having long spans without lateral support for the top flange, by the need for minimum deflection at the track, by the need for minimum width at the track as affecting stresses in track and trolley yokes, and by the need for security while supporting loads moved along the rail or vertically accelerated loads. It is desirable to join and support adjacent spans in such manner as to produce continuous-beam effects in resisting vertical loadings and in resisting lateral deflection.

The utility of the integral rail here disclosed as an article of manufacture, is that it meets all the needs and general requirements simultaneously and in an economical and efficient manner.

Among the objects of the invention may be noted the provision of an improved overhead trolley rail characterized by great strength in proportion to dead weight, and to the value of materials plus labor used in its construction; the provision of an overhead rail comprising a welded assembly of upper and lower chords and a novel and effective manner of joining the chords so as to avoid direct tension on any weld or a bending moment on any weld or a combination of such tension and bending; the provision of an overhead rail employing upper and lower chords and chord-joiners that simultaneously center the track chord under the upper structural chord, provide rigid connections between the chords, and provide resilience in resisting stresses due to side thrust of loads; the provision of an integral rail combining wide top flange, narrow bottom flange at track portion and substantial depth of rail, all in proportion to the size of the standard track section used; the provision of overhead track with a typical form of construction capable of being maintained while permitting variation in the design of individual spanning members in accordance with usual engineering practice for various

2

spans, depths, loadings and the like; the provision of trolley rail with intervals of clear space between the chord-poiners, which permit passage through the rail of supporting members, pipes, conduits and the like, above the clearance lines traced by tops of trolley wheels; and the provision of an overhead trolley track which is capable of prefabrication in complete sections for shipment and assembly on the job with each section incorporating means providing ready assembly with adjacent sections and strong connections to supports.

Other objects will be in part obvious from the annexed drawings and in part hereinafter indicated in connection therewith by the following analysis of the invention.

In the drawings:

Fig. 1 is a side elevation of one half of a shipping section of integral rail according to one embodiment of the invention, the other half being symmetrical by rotation about line 19—19 which may be taken to represent the vertical center line of the shipping section;

Fig. 2 is a section taken along line 2—2 of Fig. 3;

Fig. 3 is an enlarged side view of a portion of the rail illustrated in Fig. 1 to show the construction of the chord-joiners;

Fig. 4 is an enlarged section through the lower chord illustrating the connection of a chord-joiner therewith;

Fig. 5 is a side elevation of a partial shipping section of an integral rail of modified construction according to the invention;

Fig. 6 is an enlarged side view of a portion of the rail illustrated in Fig. 5 to show the construction of a chord-joiner;

Fig. 7 is a view similar to Fig. 4 but illustrating an alternative and cheaper section for the lower chord, and a method of connecting a chord-joiner therewith;

Fig. 8 is a section through an integral rail illustrating an alternative construction for long spans or for use under conditions requiring greater strength than provided by the structural upper chord as illustrated in other figures;

Fig. 9 is a view similar to Figs. 1 and 5 which illustrates another form of integral rail according to the invention;

Fig. 10 is a section taken along line 10—10 of Fig. 11;

Fig. 11 is an enlarged side view of a portion of the rail illustrated in Fig. 9 to show the construction of a chord-joiner;

Fig. 12 is an enlarged side view similar to Fig.

11, to show the construction of a chord-joiner as used with a single section track member.

Referring to the drawings, wherein like reference characters indicate like parts throughout the several views, **20** indicates generally a prefabricated section of integral rail according to the invention. While the length of the section will vary, the partial section of rail shown may be regarded as approximately half the length of a complete section thereof. As shown in the drawings, the said section comprises a rigidly connected assembly of a structural top chord **21** providing a wide top flange, a common hard steel track section **22** forming the bottom chord and providing at the same time a narrow track for load bearing trolley wheels, a plurality of specially formed and connected chord-joiners to be described, and two sections of web-plate **29** close to the ends of the section. Each end of the typical shipping sections shown corresponds to a point of support for the integral rail, hence plate **29** is close to a point of support.

The top chord **21** as shown in Fig. 2 preferably comprises a T made from one flange and half the web of a wide-flange I beam; but it will often be advantageous to use less than half the web, thereby making the remainder of the I beam available for another use as for a crane or for a stronger rail. In either case, there is ample space for a set of punched holes **23** at each end of the top flange, and a set of holes **24** at each end of the stem, these holes being for use in supporting the rail and splicing together sections of rail according to common structural practice.

The bottom chord **22** may take the form of a rolled section of hard steel track with two symmetrical treads for supporting overhead trolley wheels. In the preferred form of this invention, a well known track section **22** is used of two parts **22***a* and **22***b* attached together, usually by bolts **25**, **22***a* being a rolled section of hard steel with a continuous flange near the bottom of its outer face designed to support one wheel of a pair of trolley wheels and with a continuous groove and offset near the top of its inner face designed to clamp onto adjustable hangers slidable along the groove, and **22***b* being another length of the same rolled section turned end for end. Thus track **22** may be carried in stock for use with slidable hangers as per standard practice, and also for making the integral rail of this invention, the two uses supplementing each other in the monorail business.

Considering now the specially formed elements termed chord-joiners or chord connectors, and their relationships with other elements of the integral rail according to the invention, reference character **32** (Figs. 1 to 4) indicates one of a plurality of spaced chord-joiners preferably of rolled flat bar steel. The upper end of **32** is offset from the vertical plane of the rail by an amount equal to one-half of the thickness of stem of the top chord plus one-half the thickness of the bar from which the chord-joiner is made, whereby the track is centered under the top chord, and the location line of the track centers upon the connections of a rail to supports. The upper end of **32** has a rigid attachment to the stem of the top chord as by two fillet welds **33**, **34** (Fig. 3) or by two rivets. To facilitate welding and increase the strength of the rail, the fillet weld **33** may be continued across the end of bar **32** and made one with weld **34**, but the utility of portions **33** and **34** will be the same as for separate welds. Two rivets spaced apart vertically may be substituted for welds **33** and **34**, in which case they should be spaced apart the maximum practical distance on the chord-connector, to exert a force couple for resisting deformation due to internal stresses in the rail. The said rigid attachments are preferably alternated along the two sides of the stem of top chord but the symmetrical character of the rail section is variable within ordinary limits of steel designing. The lower end of the chord-joiner **32** is formed to fit inside the head groove of the track having ledges **36***a*, **36***b* which in assembly are brought into contact with the upper horizontal surfaces of the head groove, and fillet welds **37**, **38** are then made so as to form a rigid connection between chord-joiner and track. The ledges are capable of transmitting vertical loads due to loaded trolleys upon the track, without subjecting welds **37**, **38** to vertical tension. As shown in Fig. 1, the width of the chord-joiner is less than the depth of the rail and the chord-joiners are spaced apart a distance approximating two to three times the depth of the rail, these being general characteristics of the preferred form of the invention. For the species of the invention shown in Fig. 1, however, the chord-joiner **32** might be economically and efficiently made of width greater than the depth of the rail.

The intermittent spacing of the chord-joiners permits considerable latitude in the design of an individual section of rail as regards locations of chord-joiners. They may be spaced closer together near the ends of the section for increased strength of the rail; and the spacings may be varied for clearance of supports, pipes or similar obstructions desired to pass through the rail.

For light loads, and shallow depths of rail, the chord-joiners in combination with the top and bottom chords as described will be found sufficient by common methods of design or test to form an efficient section of integral rail. For most cases however, it will be desirable to use a length of web plate between the chords near each point of support of the integral rail. When such web plates are used, some of the chord-joiners may have the track sections simply clamped on, thus saving the welding at these chord-joiners.

Each end of the rail section, as illustrated in Fig. 1, is provided with a web plate **29** of rectangular outline, the upper and lower edges respectively thereof being welded to the adjacent edges of the upper and lower chords. The length of plate **29** may be varied to suit the specified strength of an individual shipping section of rail. Plate **29** is located close to the point of support of the integral rail, but allowance may be made for clearance of track splice, support and one chord-joiner. The length of plate **29** determines the locations of the two adjacent chord-joiners **32***a* of typical style **32** which are welded to the ends of plate **29**, whereby the common web plate construction takes on the advantages of the chord-joiner construction.

A modified form of chord-joiner is employed in the rail illustrated in Fig. 5 for connecting the upper chord **21** and lower chord **22**. Each chord-joiner, as shown in Fig. 6, consists of a flat rolled steel bar or plate **41** having its upper end split and the two arms **41***a*, **41***b* offset relative to each other and rigidly attached to the stem of the top chord by fillet welds **42**, **43** and **44** on each arm. Welds **42** are at the two outside edges of the bar and are capable of exerting a force couple for resisting internal stresses in the rail while simultaneously resisting tension on the chord-joiner, all resistance being accomplished by means of

welds in shear, said welds being of readily computed safe strength. The width of the chord-joiner is sufficient to space the two welds **42** and **42** a substantial distance apart as affecting the strength of the force couple. Welds **43** and **44** are supplementary tack welds, and might be omitted without impairing the total strength of the rail. Each chord-joiner **41** may have its lower end formed similarly to the chord-joiner **32** of the Figs. 1–4 modification, or similarly to the variant thereof indicated in Fig. 7, and may be rigidly connected to the lower chord as by the fillet welds **37, 38** of Fig. 4.

Fig. 7 illustrates a construction in which angles **46***a* and **46***b* of hard steel, which are secured back to back as shown, are substituted for the track sections **22***a* and **22***b* respectively. The chord-joiners **45** consequently have the modified form as shown being made as straight bars of a length to extend the full height of the angles and to project below the horizontal flanges thereof; and being fillet welded top and bottom as at **47, 48** and **47***a*, **48***a*, to the angles. In other respects, chord-joiners **45** correspond to the chord-joiners **32** (Fig. 3), or **41** (Fig. 6), or **50** (Fig. 11), the form **50** to be described hereinafter. In Fig. 8 the upper chord **21** is reinforced by a structural channel **40** for long spans or for use under conditions requiring greater strength than provided by a simple T-section.

Referring to Fig. 9, there is illustrated a rail with chord-joiners between upper and lower chords following generally the style of the chord-joiners illustrated in the Figs. 5 and 6 modification but in which the two branches are substantially spaced from each other. Thus, the chord-joiners generally indicated at **50** are of U-shape construction, the side arms or branches thereof **50***a*, **50***b* (Fig. 11) being spaced apart from each other and connected by a horizontal body **50***c* having side ledges like **36***a*, **36***b* (Fig. 4), a shank like **35** to match the slot **30** in the rail head and two fillet welds **51** like welds **37, 38** in Fig. 4. The spaced upper ends of the legs **50***a*, **50***b* are oppositely offset, the dimension of each offset being one half the thickness of the stem of the top chord plus one half the thickness of the bar from which the chord-joiner is made. The offsets are preferably made as shown in Fig. 10 with bends **52** as low as possible while clearing trolley wheels **57**, and bends **53** as high as possible while clearing the stem of the top chord. Each chord-joiner **50** is rigidly connected to the stem of the top chord by two fillet welds **54** at the outside edges of **50***a* and **50***b*. Additional fillet welds **55** and **56** may be added at the inside edges of **50***a* and **50***b* for tack welds or for supplementary strength.

The chord-joiner **50** (Fig. 11) is preferably made from a length of rectangular rolled steel bar, the mid-section of which is heated for bending and forging to form the body portion **50***c* and while in the heated condition it may be compressed longitudinally to upset the bar to provide sufficient metal for the ample height and width indicated for **50***c*, the said width being such that the body portion has end projections beyond the two arms **50***a* and **50***b*, the ample height and width being desirable to provide substantial strength for the chord-joiner where it is to be combined with the track sections.

The drawings show three typical forms of construction, any one of which might be manufactured as a type adaptable to various spans, depths, capacities and the like. The advantage of such a typical form of construction for integral-trolley rail is that the chord-joiners may be made for stock in various lengths but otherwise alike and that workman may become accustomed to uniform procedures in manufacture.

When the rail is used there will arise internal stresses which tend to change the shape of the rail with resultant deflection at the track. Noticeable deflection is objectionable and requires trolleys to be moved up-hill. A common internal stress will be resisted by the weld **54** on **50***a* and a similar weld on **50***b*, in proportion to the width of the chord-joiner. The width of the chord-joiner **50** may be defined as the distance from the outer edge of **50***a* to the outer edge of **50***b*. A somewhat greater width than shown would provide greater strength, but if the width be increased to a dimension substantially greater than the depth of the integral rail, a different style of construction will result as regards distribution of stresses, methods of design and manufacture, and open spaces thru the rail. For best meeting general requirements, the rails illustrated by Figs. 5 and 9 use chord-joiners with width dimension less than the depth of the rail.

The intermittent chord-joiners **50** are stronger in resisting buckling than a continuous or sectional web plate construction of equal depth because they are thicker. They are more economical because of the relatively large amount of open space between them, and between the arms **50***a* and **50***b*. The thickness of a chord-joiner, possible without interference with trolley-wheels and without increase in width of track, makes possible the construction of an integral rail of greater depth than those heretofore in common use. Greater depth gains increased strength and decreased deflection.

Referring generally to fillet welding of any two steel members it is desirable to have relation of parts and application of welds so that each weld is subjected in use to shearing stresses only. Welds are generally considered objectionable if subjected to tension, or to bending moments, or to tension and bending simultaneously. Integral trolley rails joined by fillet welding have been widely used in many forms. The integral rail of this invention is believed to be the first disclosure of a combination of parts and welds wherein the principal stresses are taken by welds in shear. This is true for stresses due to normal loads on movable trolleys, to side sway of loads, and to off-side hoisting.

As in prior embodiments, a rail section of the type illustrated in Fig. 9 may be provided at its ends with web plates **29** welded along their top and bottom edges to the upper and lower chords, and at their ends to typical chord-joiners.

Overhead trolley rail as described in the foregoing thus comprises a welded hence homogeneous or integral assembly of upper and lower chords, with specially formed and related chord-joiners and specially combined web plates, connecting the chords, in which the principal stresses are transmitted by welds in shear. Hence, an overhead rail constructed in accordance with the invention combines with other desirable features great strength in proportion to the dead weight thereof and to the amount of materials plus labor employed in its construction, with the rail being characterized by minimum dead weight consequent to the open-work construction between the chord-joiners. In addition to centering the lower chord directly beneath the upper chord and in such manner as to provide the necessary resilience

in resisting side thrusts due to travelling loads, the specially formed chord-joiners are such as to provide a typical form of construction and also permit passage through the rail of pipes, conduits and supporting members.

A wide upper chord with outer edges thick enough to resist buckling is attained by the use of a common structural T section rolled and fabricated for such use. A narrow bottom flange at track is attained by the use of a standard track section designed and usable for another purpose requiring a narrow trolley track, and found especially useful in the combination described herein.

Moreover, overhead track according to the invention may be prefabricated into complete sections with provisions for end splices and connections to supports whereby sections may be readily assembled and erected at the job. The specially formed and related chord-joiners are of advantage in manufacture in that they permit the chords to be trued up with a minimum expenditure of time and energy prior to the rigid connections of the various elements by the welding procedures outlined above.

Each element of the integral rail herein described may be combined with all necessary supplementary elements; therefore an integral rail according to the invention can meet all the objects of the invention simultaneously.

The preferred form of this invention uses a bottom chord track member of two rolled sections **22***a*, **22***b* (Fig. 4). Many of the advantages of the invention may be attained when using any one of the well known track members consisting of a single rolled section having two wheel-flanges near the bottom, a rail head at the top and a connecting web. Fig. 12 is a view similar to Fig. 11, showing one chord-joiner **58** as used to connect the top chord **21** and a single section rail **60** forming the bottom chord. The chord-joiner shown at **58** is formed from a rectangular bar to have a U shape construction with side arms **58***a* and **58***b* spaced apart from each other and connected by a horizontal body portion **58***c*. A weld **59** connects the chord-joiner to the rail head. Above the body portion, the arms **58***a* and **58***b* are the same as arms **50***a* and **50***b* respectively. Nothing new is claimed regarding the track **60** or the connection provided by the weld **59**, but an integral rail made with chord-joiners **58** will have the advantages of the invention with regard to all construction above the connections of the track with the chord-joiners.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A trolley rail comprising: a structural top chord having a horizontal flange and a vertical stem; a parallel bottom chord consisting of two track members of a standardized rolled section of hard steel, formed and secured together so as to provide a two-tread track for trolley wheels and a rail head having a longitudinal slot and offset grooves defined in part by two horizontal surfaces inside the rail head; a plurality of chord-connectors spaced apart along the rail; each chord-connector having near its upper end a rigid connection to the stem of the top chord, the said rigid connection including means to resist shear with portions of said means spaced apart, and the total number of means to resist shear on one side of the stem being substantially equal to the total number on the other side of the stem for the plurality of chord connectors; each chord-connector having near its lower end a side ledge on each side and extending across the width of the chord-connector, the two ledges having bearing engagement with the aforesaid horizontal surfaces inside the rail head; and rigid connections for substantially all of the chord-connectors provided by fillet welds attaching the two track members to the two sides respectively of the chord-connector and securing the chord-connector ledges and the rail-head horizontal surfaces in the bearing engagement aforesaid.

2. A trolley rail comprising: a structural top chord having a horizontal flange and a vertical stem; a parallel bottom chord consisting of two track members of a standardized rolled section of hard steel, formed and secured together so as to provide a two-tread track for trolley wheels and a rail head having a longitudinal slot and offset grooves defined in part by two horizontal surfaces inside the rail head; a plurality of chord-connectors spaced apart along the rail; each chord-connector having near its upper end a rigid connection to the stem of the top chord, the said rigid connection including means to resist shear with portions of said means spaced apart, and the total number of means to resist shear on one side of the stem being substantially equal to the total number on the other side of the stem for the plurality of chord connectors; each chord-connector having near the lower end a side ledge on each side and extending across the width of the chord-connector, the two ledges having bearing engagement with the aforesaid horizontal surfaces inside the rail head; rigid connections for substantially all of the chord-connectors provided by fillet welds attaching the two track members to the two sides respectively of the chord-connector and securing the chord-connector ledges and the rail-head horizontal surfaces in the bearing engagement aforesaid; and rectangular plates adjacent the points of support of the trolley rail, each plate having its upper edge welded to the edge of said stem, its lower edge welded to said rail head, and its other two edges determining the locations of the two adjacent chord-connectors and being welded thereto respectively.

3. A trolley rail comprising: a monorail bottom chord; a structural top chord parallel thereto and having a horizontal flange and a vertical stem with the flange forming the top of the trolley rail; a plurality of chord-connectors spaced apart throughout the length of the said rail and connected to the said bottom chord; each chord-connector having near its upper end a rigid connection to the stem of the top chord, the said rigid connection including fastening means to resist shear with portions of said means spaced apart a substantial distance on said stem, and the total number of means to resist shear on one side of the stem being substantially equal to the total number on the other side of the stem for the plurality of chord connectors.

4. A trolley rail including a top chord and a parallel bottom chord consisting of two track members of a standardized rolled section of hard steel, formed and secured together so as to provide a two-tread track for trolley wheels and a rail head having a longitudinal slot and offset grooves defined in part by two horizontal surfaces inside the rail head, and including a discontinu-

ous series of chord connectors between the top and bottom chords, characterized by: said top chord including one flange and a portion of the web of a wide-flange structural I beam, the flange width of the top chord being more than twice the flange width of the bottom chord; the top and bottom chords being spaced apart so that the distance between them is greater than the depth of the bottom chord; a plurality of chord-connectors spaced apart along the trolley rail; each chord-connector being connected rigidly to the top chord; each chord-connector having near its lower end a side ledge on each side and extending across the width of the chord-connector, the two ledges having bearing engagement with the aforesaid horizontal surfaces inside the rail head; and rigid connections for substantially all of the chord-connectors provided by fillet welds attaching the two track members to the two sides respectively of the chord-connector and securing the chord-connector ledges and the rail-head horizontal surfaces in the bearing engagement aforesaid.

5. A trolley rail comprising: a structural top chord having a horizontal flange and a vertical stem; a parallel bottom chord consisting of two track members of a standardized rolled section of hard steel, formed and secured together so as to provide a two-tread track for trolley wheels and a rail head having a longitudinal slot and offset grooves defined in part by two horizontal surfaces inside the rail head; a plurality of chord-connectors spaced apart along the rail; each chord connector having the form of a flat bar of width less than the depth of the trolley rail; said bar having its upper end offset, the dimension of the offset being one half the thickness of the stem of the top chord plus one half the thickness of the bar, having its upper end rigidly connected to the stem of the top chord by two vertical fillet welds spaced apart the width of the bar, the said offset and connected ends alternating generally between the two sides of the stem; said bar having near its lower end a side ledge on each side and extending across the width of the bar, the two ledges having bearing engagement with the aforesaid horizontal surfaces inside the rail head; and rigid connections for substantially all of the chord-connectors provided by fillet welds attaching the two track members to the two sides respectively of the chord-connector and securing the chord-connector ledges and the rail-head horizontal surfaces in the bearing engagement aforesaid.

6. A trolley rail comprising: a structural top chord having a horizontal flange and a vertical stem; a parallel bottom chord consisting of two track members of a standardized rolled section of hard steel, formed and secured together so as to provide a two tread track for trolley wheels and a rail head having a longitudinal slot and offset grooves defined in part by two horizontal surfaces inside the rail head; a plurality of chord-connectors spaced apart along the rail; each chord connector having the form of a flat bar of width less than the depth of the trolley rail; said bar having its upper end offset, the dimension of the offset being one half the thickness of the stem of the top chord plus one half the thickness of the bar, having its upper end rigidly connected to the stem of the top chord by two vertical fillet welds spaced apart the width of the bar, the said offset and connected ends alternating generally between the two sides of the stem; said bar having near its lower end a side ledge on each side and extending across the width of the bar, the two ledges having bearing engagement with the aforesaid horizontal surfaces inside the rail head; rigid connections for substantially all of the chord-connectors provided by fillet welds attaching the two track members to the two sides respectively of the chord-connector and securing the chord-connector ledges and the rail-head horizontal surfaces in the bearing engagement aforesaid; and rectangular plates adjacent the points of support of the trolley rail, each plate having its upper edge welded to the edge of said stem, its lower edge welded to said rail head, and its other two edges determining the locations of the two adjacent chord-connectors and being welded thereto respectively.

7. A trolley rail comprising: a structural top chord having a horizontal flange and a vertical stem; a parallel bottom chord consisting of two track members of a standardized rolled section of hard steel, formed and secured together so as to provide a two-tread track for trolley wheels and a rail head having a longitudinal slot and offset grooves defined in part by two horizontal surfaces inside the rail head; a plurality of chord-connectors spaced apart along the rail, each chord connector being formed from a steel bar of width less than the depth of the trolley rail and having its upper end split into two substantially equal parts and the two parts oppositely offset, the dimension of each offset being one half the thickness of the stem of the top chord plus one half the thickness of the bar; each chord connector having near its upper end a rigid connection to the stem of the top chord, the said rigid connection including two vertical fillet welds spaced apart the width of the bar and on opposite sides of said stem; each chord-connector having near its lower end a side ledge on each side and extending across the width of the chord-connector, the two ledges having bearing engagement with the aforesaid horizontal surfaces inside the rail head; and rigid connections for substantially all of the chord-connectors provided by fillet welds attaching the two track members to the two sides respectively of the chord-connector and securing the chord-connector ledges and the rail-head horizontal surfaces in the bearing engagement aforesaid.

8. A trolley rail comprising: a structural top chord having a horizontal flange and a vertical stem; a parallel bottom chord consisting of two track members of a standardized rolled section of hard steel, formed and secured together so as to provide a two-tread track for trolley wheels and a rail head having a longitudinal slot and offset grooves defined in part by two horizontal surfaces inside the rail head; a plurality of chord-connectors spaced apart along the rail, each chord-connector being formed from a steel bar of width less than the depth of the integral rail and having its upper end split into two substantially equal parts and the two parts oppositely offset, the dimension of each offset being one half of the thickness of the stem of the top chord plus one half the thickness of the bar; each chord connector having near its upper end a rigid connection to the stem of the top chord, the said rigid connection including two vertical fillet welds spaced apart the width of the bar and on opposite sides of said stem; each chord connector having near its lower end a side ledge on each side and extending across the width of the chord-connector, the two ledges having bearing engage-

ment with the aforesaid horizontal surfaces inside the rail head; rigid connections for substantially all of the chord-connectors provided by fillet welds attaching the two track members to the two sides respectively of the chord-connector and securing the chord-connector ledges and the rail-head horizontal surfaces in the bearing engagement aforesaid; and rectangular plates adjacent the points of support of the trolley rail, each plate having its upper edge welded to the edge of said stem, its lower edge welded to said rail head, and its other two edges determining the locations of the two adjacent chord connectors and being welded thereto respectively.

9. A trolley rail comprising: a structural top chord having a horizontal flange and a vertical stem; a parallel bottom chord consisting of two track members of a standardized rolled section of hard steel, formed and secured together so as to provide a two-tread track for trolley wheels and a rail head having a longitudinal slot and offset grooves defined in part by two horizontal surfaces inside the rail head; a plurality of chord-connectors spaced apart along the rail, each chord-connector having a rectangular U shape of width less than the depth of the trolley rail, the arms of the U being oppositely offset and the dimension of each offset being one half the thickness of the stem of the top chord plus one half the thickness of the arm; each chord connector having near its upper end a rigid connection to the stem of the top chord, the said rigid connection including two vertical fillet welds spaced apart the width of the U and on opposite sides of said stem; each chord connector having near its lower end a side ledge on each side and extending across the width of the chord connector, the two ledges having bearing engagement with the aforesaid horizontal surfaces inside the rail head; and rigid connections for substantially all of the chord connectors provided by fillet welds attaching the two track members to the two sides respectively of the chord connector and securing the chord-connector ledges and the rail-head horizontal surfaces in the bearing engagement aforesaid.

10. A trolley rail comprising: a structural top chord having a horizontal flange and a vertical stem; a parallel bottom chord consisting of two track members of a standardized rolled section of hard steel, formed and secured together so as to provide a two-tread track for trolley wheels and a rail head having a longitudinal slot and offset grooves defined in part by two horizontal surfaces inside the rail head; a plurality of chord connectors spaced apart along the rail, each chord connector having a rectangular U shape of width less than the depth of the trolley rail, the arms of the U being oppositely offset and the dimension of each offset being one half the thickness of the stem of the top chord plus one half the thickness of the arm; each chord connector having near its upper end a rigid connection to the stem of the top chord, the said rigid connection including two vertical fillet welds spaced apart the width of the U and on opposite sides of said stem; each chord connector having near its lower end a side ledge on each side and extending across the width of the chord connector, the two ledges having bearing engagement with the aforesaid horizontal surfaces inside the rail head; rigid connections for substantially all of the chord connectors provided by fillet welds attaching the two track members to the two sides respectively of the chord connector and securing the chord-connector ledges and the rail-head horizontal surfaces in the bearing engagement aforesaid; and rectangular plates adjacent the points of support of the trolley rail, each plate having its upper edge welded to the edge of said stem, its lower edge welded to said rail head, and its other two edges determining the locations of the two adjacent chord connectors and being welded thereto respectively.

11. A trolley rail comprising: a bottom chord suitable for the movement thereon of load bearing trolley wheels; a structural top chord parallel to and spaced at a substantial distance from the bottom chord and having a horizontal flange forming the top of the trolley rail and a vertical stem projecting downwardly; a plurality of chord connectors between the bottom chord and the top chord, which are spaced apart along the trolley rail so as to form a plurality of clear spaces through the trolley rail between said chords and said chord connectors, with the clear spaces alternating with the chord connectors at least through the greater and intermediate portion of the length of the trolley rail, the vertical dimension of each clear space being of substantial degree in proportion to the size of the bottom chord and the longitudinal dimensions of the clear spaces generally being of substantial degree in proportion to the width of a chord connector; each chord connector being welded at its lower portion to the bottom chord; each chord connector being welded at its upper portion to the stem of the top chord at at least two points spaced apart a substantial distance on the said stem, with the amount of welding on one side of the stem being substantially equal to the amount of welding on the other side of the stem for the plurality of chord connectors; and each chord connector including at least one offset, the dimension of each offset being substantially equal to half the thickness of the stem of the top chord plus half the thickness of the chord connector.

12. A trolley rail comprising: a bottom chord suitable for the movement thereon of load bearing trolley wheels; a structural top chord parallel to and spaced at a substantial distance from the bottom chord and having a horizontal flange forming the top of the trolley rail and a vertical stem projecting downwardly; a plurality of chord connectors between the bottom chord and the top chord, which are spaced apart along the trolley rail so as to form a plurality of clear spaces through the trolley rail between said chords and said chord connectors, with the clear spaces alternating with the chord connectors at least through the greater and intermediate portion of the length of the trolley rail, the vertical dimension of each clear space being of substantial degree in proportion to the size of the bottom chord and the longitudinal dimensions of the clear spaces generally being of substantial degree in proportion to the width of a chord connector; each chord connector being welded at its lower portion to the bottom chord; and each chord connector being welded at its upper portion to the stem of the top chord at at least two points spaced apart a substantial distance on the said stem, with the amount of welding on one side of the stem being substantially equal to the amount of welding on the other side of the stem for the plurality of chord connectors.

13. A trolley rail comprising: a bottom chord suitable for the movement thereon of load bearing trolley wheels; a structural top chord parallel to and spaced at a substantial distance from

the bottom chord and having a horizontal flange forming the top of the trolley rail and a vertical stem projecting downwardly; a plurality of chord connectors between the bottom chord and the top chord, which are spaced apart along the trolley rail so as to form a plurality of clear spaces through the trolley rail between said chords and said chord connectors, with the clear spaces alternating with the chord connectors at least through the greater and intermediate portion of the length of the trolley rail, the vertical dimension of each clear space being of substantial degree in proportion to the size of the bottom chord and the longitudinal dimensions of the clear spaces generally being of substantial degree in proportion to the width of a chord connector; each chord connector having the form of a rectangular plate or bar with the longer dimension vertical, when viewed from the side of the trolley rail, the lower portion of the bar being welded to the upper portion of the bottom chord, the upper portion of the bar being offset, the dimension of the offset being one half the thickness of the stem of the top chord plus one half the thickness of the bar, and being connected to the stem of the top chord by at least two fillet welds spaced apart a substantial distance on the said stem; and the offset and connected ends of the plurality of chord connectors, alternating generally between the two sides of the stem of the top chord.

14. The combination of the structure set forth in claim 13 together with rectangular plates adjacent to the points of support of the trolley rail, each plate having its upper edge welded to the stem of the top chord, and its lower edge welded to the uppermost portion of the bottom chord.

15. A trolley rail comprising: a bottom chord suitable for the movement thereon of load bearing trolley wheels; a structural top chord parallel to and spaced at a substantial distance from the bottom chord and having a horizontal flange forming the top of the trolley rail and a vertical stem projecting downwardly; a plurality of chord connectors between the bottom chord and the top chord, which are spaced apart along the trolley rail so as to form a plurality of clear spaces through the trolley rail between said chords and said chord connectors, with the clear spaces alternating with the chord connectors at least through the greater and intermediate portion of the length of the trolley rail, the vertical dimension of each clear space being of substantial degree in proportion to the size of the bottom chord and the longitudinal dimensions of the clear spaces generally being of substantial degree in proportion to the width of a chord connector; and each chord connector having the form of a rectangular plate or bar with the longer dimension vertical, when viewed from the side of the trolley rail, the lower portion of the bar being welded to the upper portion of the bottom chord, the upper portion of the bar being split into two substantially equal parts and the two parts being oppositely offset, the dimension of each offset being one half the thickness of the stem of the top chord plus one half the thickness of the bar, and being connected to the said stem by at least two vertical fillet welds spaced apart the width of the bar and on opposite sides of the stem.

16. The combination of the structure set forth in claim 15 together with rectangular plates adjacent to the points of support of the trolley rail, each plate having its upper edge welded to the stem of the top chord, and its lower edge

welded to the uppermost portion of the bottom chord.

17. A trolley rail comprising: a bottom chord suitable for the movement thereon of load bearing trolley wheels; a structural top chord parallel to and spaced at a substantial distance from the bottom chord and having a horizontal flange forming the top of the trolley rail and a vertical stem projecting downwardly; a plurality of chord connectors between the bottom chord and the top chord, which are spaced apart along the trolley rail so as to form a plurality of clear spaces through the trolley rail between said chords and said chord connectors, with the clear spaces alternating with the chord connectors at least through the greater and intermediate portion of the length of the trolley rail, the vertical dimension of each clear space being of substantial degree in proportion to the size of the bottom chord and the longitudinal dimensions of the clear spaces generally being of substantial degree in proportion to the width of a chord connector; each chord connector having a U shape as viewed from the side of the trolley rail, the lower portion of the U having a horizontal portion of substantial length, said horizontal portion being welded to the upper portion of the bottom chord, the upper portion of the U being in the form of two arms spaced apart a substantial distance in proportion to the depth of the top chord, each arm being offset, the dimension of each offset being one half the thickness of the stem of the top chord plus one half the thickness of the arm, and each arm being connected to the stem of the top chord by means of fillet welding; and the amount of fillet welding on one side of the stem being substantially equal to the amount on the other side of the stem, for the plurality of chord-connectors.

18. The combination of the structure set forth in claim 17 together with rectangular plates adjacent to the points of support of the trolley rail, each plate having its upper edge welded to the stem of the top chord, and its lower edge welded to the uppermost portion of the bottom chord.

19. A trolley rail comprising: a structural top chord having a horizontal top flange forming the top of the trolley rail and a vertical stem projecting downwardly; a parallel bottom chord consisting of two track members of a standardized rolled section of hard steel, formed and secured together so as to provide a two-tread track for trolley wheels and a rail head having a longitudinal slot and offset grooves defined in part by two horizontal surfaces inside the rail head; a plurality of chord connectors between the top chord and the bottom chord, which are spaced apart along the trolley rail so as to form a plurality of clear spaces through the trolley rail between said chords and said chord connectors, with the clear spaces alternating with the chord connectors at least through the greater and intermediate portion of the length of the trolley rail, the vertical dimension of each clear space being of substantial degree in proportion to the size of the bottom chord and the longitudinal dimensions of the clear spaces generally being of substantial degree in proportion to the width of a chord connector; each chord connector having the form of a recetangular plate or bar with the longer dimension vertical, when viewed from the side of the trolley rail; said bar having its upper end offset, the dimension of the offset being one half the thickness of the stem of the top chord

plus one half the thickness of the bar, and having its upper end rigidly connected to the stem of the top chord by at least two fillet welds spaced apart on the said stem a distance substantially equal to the width of the bar, the said offset and connected ends alternating generally between the two sides of the stem; said bar having near its lower end a side ledge on each side and extending across the width of the bar, the two ledges having bearing engagement with the aforesaid horizontal surfaces inside the rail head; rigid connections for substantially all of the chord connectors provided by fillet welds attaching the two track members to the two sides respectively of the chord connector and securing the rail-head horizontal surfaces in the bearing engagement aforesaid; and rectangular plates adjacent to the points of support of the trolley rail, each plate having its upper edge welded to the stem of the top chord, and its lower portion welded to the uppermost portion of the bottom chord.

20. A trolley rail comprising: a structural top chord having a horizontal top flange forming the top of the trolley rail and a vertical stem projecting downwardly; a parallel bottom chord consisting of two track members of a standardized rolled section of hard steel, formed and secured together so as to provide a two-tread track for trolley wheels and a rail head having a longitudinal slot and offset grooves defined in part by two horizontal surfaces inside the rail head; a plurality of chord connectors between the top chord and the bottom chord, which are spaced apart along the trolley rail so as to form a plurality of clear spaces through the trolley rail between said chords and said chord connectors, with the clear spaces alternating with the chord connectors at least through the greater and intermediate portion of the length of the trolley rail, the vertical dimension of each clear space being of substantial degree in proportion to the size of the bottom chord and the longitudinal dimensions of the clear spaces generally being of substantial degree in proportion to the width of the chord connector; each chord connector having the form of a rectangular plate or bar with the longer dimension vertical when viewed from the side of the trolley rail; said bar having its upper end split into two substantially equal parts and the two parts oppositely offset, the dimension of each offset being one half the thickness of the stem of the top chord plus one half the thickness of the bar, and being connected to the said stem by at least two vertical fillet welds spaced apart the width of the bar and on opposite sides of the stem; said bar having near its lower end a side ledge on each side and extending across the width of the bar, the two ledges having bearing engagement with the aforesaid horizontal surfaces inside the rail head; rigid connections for substantially all of the chord connectors provided by fillet welds attaching the two track members to the two sides respectively of the chord connector and securing the rail-head horizontal surfaces in the bearing engagement aforesaid; and rectangular plates adjacent to the points of support of the trolley rail, each plate having its upper edge welded to the stem of the top chord, and its lower portion welded to the uppermost portion of the bottom chord.

21. A trolley rail comprising: a structural top chord having a horizontal top flange forming the top of the trolley rail and a vertical stem projecting downwardly; a parallel bottom chord consisting of two track members of a standardized rolled section of hard steel, formed and secured together so as to provide a two-tread track for trolley wheels and a rail head having a longitudinal slot and offset grooves defined in part by two horizontal surfaces inside the rail head; a plurality of chord connectors between the top chord and the bottom chord, which are spaced apart along the trolley rail so as to form a plurality of clear spaces through the trolley rail between said chords and said chord connectors, with the clear spaces alternating with the chord connectors at least through the greater and intermediate portion of the length of the trolley rail, the vertical dimension of each clear space being of substantial degree in proportion to the size of the bottom chord and the longitudinal dimensions of the clear spaces generally being of substantial degree in proportion to the width of the chord connector; each chord connector having a U shape as viewed from the side of the trolley rail, the lower part of the U having a horizontal portion of substantial length including a side ledge on each side and extending across the said horizontal portion, the two ledges having bearing engagement with the aforesaid horizontal surfaces inside the rail head; rigid connections for substantially all of the chord connectors provided by fillet welds attaching the two track members to the two sides respectively of the horizontal portion of the chord connector and securing the rail-head horizontal surfaces in the bearing engagement aforesaid; the upper portion of each chord connector being in the form of two arms spaced apart a substantial distance in proportion to the depth of the top chord, each arm being offset, the dimension of each offset being one half the thickness of the stem of the top chord plus one half the thickness of the arm, each arm being connected to the stem of the top chord by means of fillet welding, and the amount of fillet welding on one side of the stem being substantially equal to the amount on the other side of the stem, for the plurality of chord connectors; and rectangular plates adjacent to the points of support of the trolley rail, each plate having its upper edge welded to the stem of the top chord, and its lower portion welded to the uppermost portion of the bottom chord.

BURTIS B. McCARN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
885,001	Cameron	Apr. 14, 1908
1,592,814	Harris	July 13, 1926
1,649,577	Coryell	Nov. 15, 1927
1,722,291	Hanak	July 30, 1929
1,935,758	Zabriskie	Nov. 21, 1933
2,163,888	Nelles	June 27, 1939
2,331,860	Stevens	Oct. 12, 1943

FOREIGN PATENTS

Number	Country	Date
660,390	France	Feb. 18, 1929