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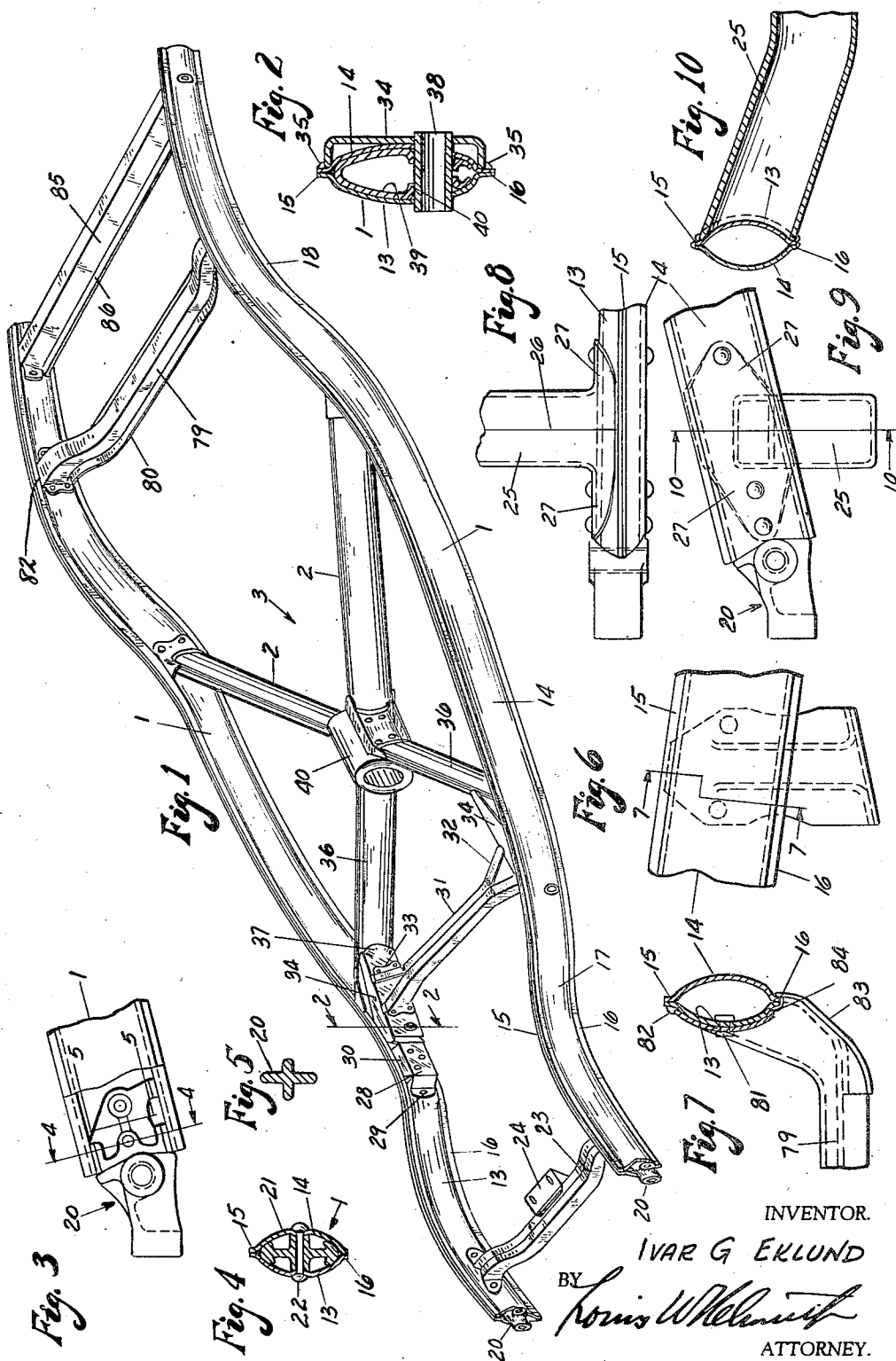
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VEHICLE FRAME AND METHOD OF MAKING SAME

Filed June 5, 1936

3 Sheets-Sheet 1



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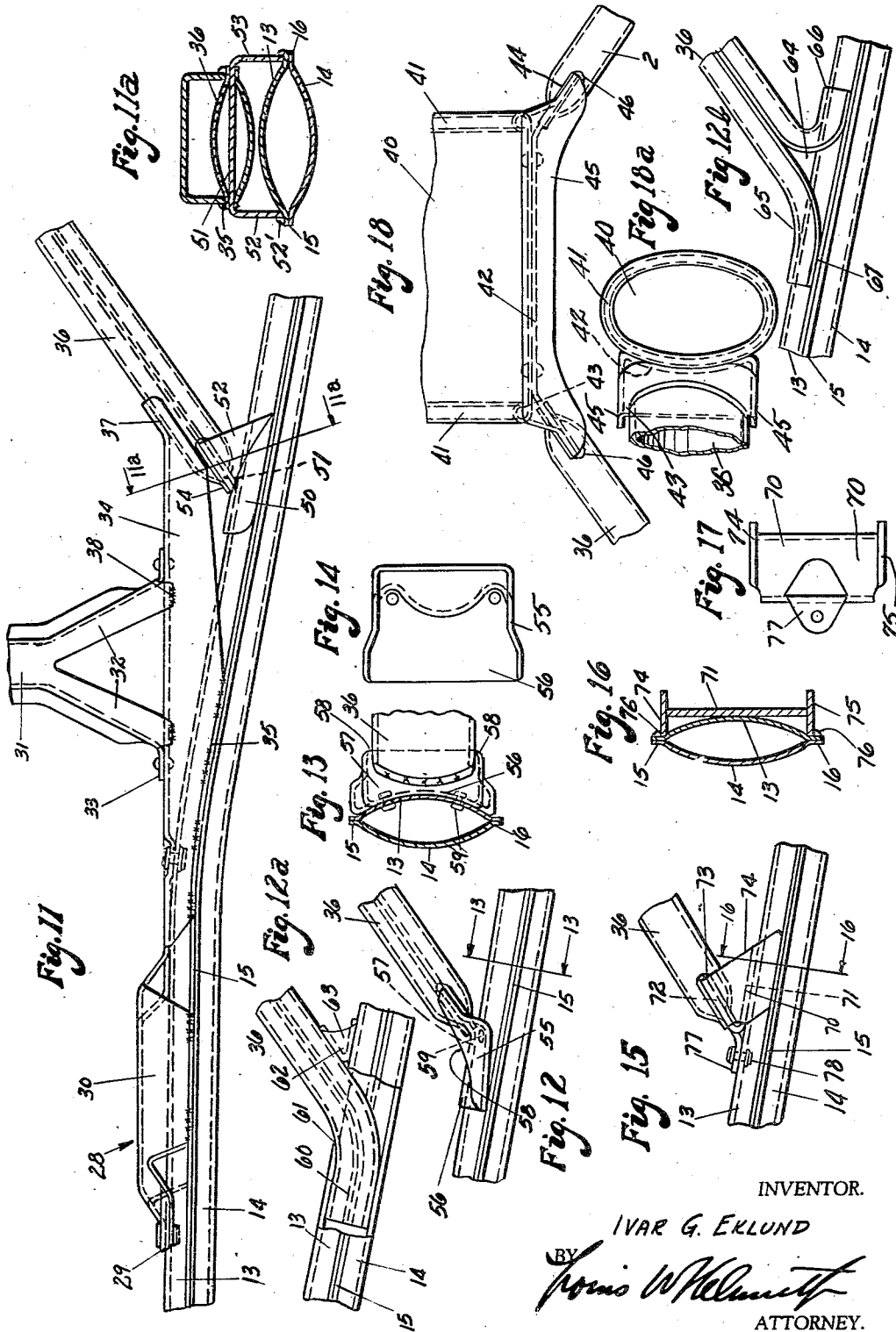
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VEHICLE FRAME AND METHOD OF MAKING
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Application June 5, 1936, Serial No. 83,719

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This invention relates to new and useful improvements in vehicle frames and an important object of the invention is to increase the resistance of the frame to beam loading while maintaining its torsional value to a high degree to produce a frame of lighter weight than those used in the past.

Another important object of the invention is to provide a frame including a pair of side rails of tubular section throughout their entire length in combination with an X-shaped cross member having its arms formed into tubular or box section.

A further object is to provide special joints between the side rails and cross members which are strong in torsion and shear and which effectively transmit stress from one rail to the other to provide a light weight rigid frame.

Another object is to provide efficient spring hanger mountings for light gauge side rails.

A still further object of the invention is to provide a strong intersection for the arms of the X-shaped cross member which will provide requisite clearance for the propeller or drive shaft of the vehicle.

Other objects and advantages of the invention will become apparent during the course of the following description.

In the accompanying drawings forming a part of the application and wherein like numerals are employed to designate like parts throughout the several views.

Fig. 1 is a perspective view of the improved frame,

Fig. 2 is a transverse section of the same taken on the line 2—2 of Fig. 1,

Fig. 3 is an enlarged side elevation of the extreme forward end of the rail and bumper and spring hanger bracket associated therewith,

Fig. 4 is a transverse section of the same taken on the line 4—4 of Fig. 3,

Fig. 5 is a transverse section taken on the line 5—5 of Fig. 3,

Fig. 6 is a side elevation of a portion of the rail showing the attachment of the third straight cross member thereto,

Fig. 7 is a section of the same taken on the line 7—7 of Fig. 6,

Fig. 8 is a top plan of a portion of either forward or rear end of the side rail showing another form of cross member attached thereto,

Fig. 9 is a side elevation thereof,

Fig. 10 is a transverse section taken on the line 10—10 of Fig. 9,

Fig. 11 is an enlarged top plan of a portion of one of the side rails of Fig. 1 in the vicinity of the attachment of one of the arms of the X-shaped middle cross member,

Fig. 11a is a transverse section of the same taken on the line 11a—11a of Fig. 11,

Fig. 12 is an enlarged top plan of a portion of the rail of Fig. 1 showing one form of attachment of bracket, to each of the four arms of the X-shaped middle cross member and the rail,

Fig. 12a is an enlarged top plan view of a portion of the side rail of Fig. 1 showing another form of attachment between each of the four arms of the X-shaped middle cross member and the rail with parts broken away,

Fig. 12b is a similar view of another modified connection as in Fig. 12a,

Fig. 13 is a transverse section of the same taken on the line 13—13 of Fig. 12,

Fig. 14 is an enlarged elevation of the attachment bracket of Figs. 12 and 13,

Fig. 15 is an enlarged top plan of a portion of the side rail of Fig. 1 showing another form of attachment bracket for each of the four arms of the X-shaped cross member thereto,

Fig. 16 is a transverse section of the same taken on the line 16—16 of Fig. 15,

Fig. 17 is an enlarged elevation of the attachment bracket of Figs. 15 and 16,

Fig. 18 is an enlarged fragmentary top plan of one-half of the intersection of the four arms of the X-shaped middle cross member of Fig. 1,

Fig. 18a is a smaller view showing an end elevation of the intersection of Fig. 18,

Fig. 19 is a perspective view of a modified form of tubular frame,

Fig. 20 is a fragmentary plan of the joint between the X-member arms and the side rails,

Fig. 21 is a section thereof taken on the line 21—21 of Fig. 20,

Figs. 22, 23 and 24 are transverse sections of modified shapes of sections for either the arms of the X-member or the side rails of either frame illustrated.

Fig. 25 is a transverse section of a single blank after the first form for the formation of tubular side rails, cross members, or arms of the X-members.

Fig. 26 is a top plan of the joint between the rearmost cross member and side rails of Fig. 1,

Fig. 27 is a side elevation of the same,

Fig. 28 is a transverse section taken on the line 28—28 of Fig. 27.

It has been the constant endeavor of the automotive industry, year after year, to reduce the weight of an automobile frame and the present inventions have as their main object, the provision of construction which will provide for the fabrication of these frames out of very light gauge stock such as No. 16 gauge or thereabout. This is accomplished primarily by making the side rails of the frame tubular "seed shape" in section throughout their entire lengths as well as the arms 2 of the X-shaped cross member which is designated in its entirety by the numeral 3. All four arms of the X-member, the

two side rails of the frame and certain of the straight transverse cross members are preferably made substantially elliptic or "seed shape" in cross section with the major axis of the ellipse in vertical planes as shown in Figs. 22 to 24. These sections are not truly elliptical or oval but rather have their minor ends formed into somewhat of points or apices to increase their section modulus and resistance to beam loads and torsion. These sections may be formed from one piece of stock as shown in Fig. 25 into the form shown in Figs. 22 or 23 from flat stock by means of dies to provide a pair of parallel longitudinally extending depressions forming convex sides A each terminating at their free ends with or without straight flanges 5 adapted to be subsequently brought together by bending the stamping along its longitudinal center line so that the two flanges 5 or edges can be welded preferably by spot or seam welding or otherwise suitably secured together to form the member into the hollow cross section illustrated. Instead of forming the central part 7 of the stamping on a very small radius or bend to give the form shown in Fig. 22, it may be folded along the dotted lines 6 as shown in Fig. 23 to provide a flange of double thickness longitudinally of the section and opposite to the flanges 5 so that flanges on the top and bottom of this elliptical structure will be arranged in the same vertical planes when the section is completed.

The side rails and arms of the X-member may also be formed as shown in Fig. 24 from a pair of convex stampings 9 and 10 each of which is bent to provide an inwardly extending flange 11 and an outwardly extending coplanar flange 12 along their longitudinal edges to be united with corresponding flanges on the other sections 10 as shown in Fig. 24. From this it will be apparent that the double thickness flange 11 along one edge will be disposed interiorly of the tubular section while the other double thickness flange 12 will be disposed exteriorly. The form shown in Fig. 23 illustrates the arms of the X-member, cross members and side rails as composed of two separate convex stampings 13 and 14 which are of identical shape and each provided at its longitudinal edges with outwardly extending flanges which is adapted to be placed in juxtaposition with respect to the complementary flanges on the other section to provide a double thickness upper vertical flange 15 and a lower coplanar vertical flange 16, which not only increase the strength of the section but forms means for facilitating the location and assembly of cross members and other adjuncts to side rails. The structure of Fig. 23 of two pressed metal parts for a side rail lends itself admirably to simple forming and bending equipment and to present day side rails having front and rear kickups 17 and 18 which require longitudinal bending in vertical planes and the belly mid-section requiring bending in horizontal planes. The gauge of the stock permits bending of the rails to shape in a jig and permanently maintaining such curvature by the fastening of the component parts of the rails together and the attachment of cross members thereto.

This type of construction also lends itself better to the formation of providing the side rails with an outward bow in a horizontal plane necessary to achieve more interior body room inside of the vehicle and also to the easy attachment of body panels to the side rails.

Fitted into the extreme forward end of each

tubular side rail is a malleable bumper bracket and front spring hanger as shown in Figs. 3 to 5 inclusive. This bracket 20 is of substantially cruciform cross section as best appreciated from Figs. 4 and 5, the cross arm 21 of which is tubular with the ends countersunk to snugly receive countersunk margins of openings in the two side walls of the tubular side rail which in turn receive the countersunk portions of rivets or bolts 22 for fastening the bracket within the rail in a manner so that vibration of the bracket will not cause the fastenings to enlarge the openings in the thin gauge side rail material. The upper and lower portions of the housed part of the bracket 20 which fit within the apices of the rail are originally of T-shape and are preferably deformed into the shape of the rail shown in Fig. 4 by pressure on the stampings forming the side rail so as to cause the brackets to have a very snug fit within the completed rail.

A box section forward cross member 23 formed from a pair of channel stampings butt welded along longitudinal lines connects the forward ends of the rails together as shown. This front cross member is of the drop type with an intermediate motor support 24 secured thereto in any suitable manner. The sides of each end of this cross member are bent laterally and are curved to fit the contour of the inner web 13 to be welded around its margins thereto or fastened by means of special rivets such as those patented by Huck and Miller on February 11, 1936 as in Patent No. 2,030,171 and others of the same date.

In Figs. 8 and 9 a modified form of cross member is illustrated as being composed of a pair of semi-circular stampings butt welded longitudinally along the lines 26 to form a circular and tubular cross member. The ends of the cross member are bent outwardly as at 27 to form feet to be attached to the side rails. These feet 27 are shaped to conform to the shape of the side rail and more particularly the inner section 13 thereof so as to snugly fit the same. These feet may be riveted or welded along their margins and it will be noted that the upper and lower edges substantially abut the upper and lower flanges 15 and 16 of the side rail to be arc welded thereto also.

A steering post bracket 28 may be secured to either side rail and is preferably composed of a substantially rectangular stamping having its ends provided with laterally projecting feet 29 arcuated in a direction to conform to the shape of the side rail to be welded or riveted thereto as in the case of cross members. The upper and lower flanges 30 of this bracket are turned inwardly to abut the inner side of the tubular rail at the juncture of the flanges 15 and 16 with the web portion so that these flanges may be readily arc welded to the rail.

A second cross member 31 forms a rear motor as well as transmission support and is composed of a pair of facing channels butt welded together to form the cross member into tubular section. The ends 32 of this cross member diverge outwardly and are provided with suitable flanges 33 for welding or riveting to a truss member 34 of generally channel shape configuration as best seen in Fig. 2. The ends of the truss member embrace the inner convex wall of the side rail and the forwardly extending arm of the X-shaped cross member 3 can rest upon the shoulders formed between the convex side walls of the side rails and the vertically extending flanges 15 and 16 so that a welded joint 35 can readily be made

therebetween. The web of the channel 34 continues rearwardly from the tubular side rail in a substantially straight line to meet the forwardly extending arm 36 of the X-member with an angular extending transversely arcuated foot 37 which snugly fits the curved side wall of the arm 36 to be riveted or welded thereto. This straight continuation of the truss 34 together with the outward bow of the side rail provides a truss construction bridging the angle formed between each forward arm 36 of the X-member and the side rail as best appreciated from Fig. 11. The ends of the horizontal flanges of the ends 32 preferably overlap the upper flange of the truss member 34 and are welded thereto as at 38. In some frames these truss members 34 may be entirely dispensed with, in which event the second cross member 31 may have its ends secured directly to the side rails and forward arms 36 of the X-member. The substantial equivalent of this truss member may be obtained by securing the forward arm 32 of the cross member directly to the inner web of the side rail, while the rear arms 32 of this cross member may be fixedly secured to each of the forwardly extending arms 36 of the X-member. However, where the truss members 34 are employed, provision is made for mounting the rear ends of the forward springs in both the side rails and these truss members, as shown in detail in Fig. 2. A short tubular member 38 is extended transversely through both side walls 13 and 14 of the tubular side rail and also through an opening in the web of truss member 34 and may be welded or otherwise suitably secured to these three walls. In view of the light gauge material employed in the construction of the side rails, it is desirable to reinforce the side rails where these members 38 extend with either a substantially oval-shaped section 39 in the form of a heavier gauge stamping than the side rails, or a malleable casting snugly filling the section of the side rail at this point. In either event, this reinforcement 39 is provided in opposite side walls with inwardly extending tubular extensions 40 snugly receiving the tubular member 38 for the reception of rear hangers of front semi-elliptic springs. In the event the cross member 34 is not employed, the tubes 38 may extend through opposite side walls of the tubular rails in the same manner and be welded thereto.

Rearwardly of the second cross member and substantially at the mid-section of the frame, an X-shaped cross member 3 is provided to connect the two side rails 1 and is composed of two rearwardly diverging arms 2 and two forwardly diverging arms 36 all intersecting and connected at the center of the frame by a housing 40. This housing is tubular and of sufficient size to allow for the projection of the propeller or drive shaft therethrough with sufficient clearance to permit the usual movements of the shaft without its contacting with the housing. In addition to being tubular, this housing is of substantially oval section, the major axis of which is arranged in a vertical plane. It is made extremely strong as a torsion and stress transmitting intersection by having its edges 41 rolled inwardly to engage the side walls and form a hollow head extending circumferentially of the housing at each end. This housing may be formed of one piece of metal rolled into oval section with a single longitudinally extending seam, or it may be formed in two halves welded together preferably along the sides thereof so as to preserve the upper and lower arches thereof integral and therefore render it

more resistant to stresses and loads of all descriptions. When made from one piece of stock, the stock is rolled into cylindrical form and welded longitudinally. This cylindrical housing is then placed in a press with upper and lower dies for simultaneously curling the end edges inwardly and rolling the beads 41 simultaneously. After this operation, the cylindrical housing is then subjected to sidewise pressure in suitable dies to form it into the proper elliptical or oval section.

The four arms 2 and 36 of the X-member are of the same substantially elliptical cross section as the side rails and may be constructed in the same manner as the side rails to possess the requisite sections, some of which are shown in Figs. 22 and 24 inclusive. These arms may be of uniform section throughout, although if it is desired to increase the beam strength thereof the inner ends of each of the four arms adjacent the housing 40 may be of increased depth or section over their outer ends. Preferably, the four arms of the X-member are arranged so that one rear arm 2 is in longitudinal alignment with the diagonally opposite forward arm 36.

Each of the arms 2 and 36 of the X-member are preferably formed from a single piece of metal as in Fig. 22 with a single longitudinally extending seam or pair of flanges. For connecting a pair of the tubular arms of the X-member adjacent one side of the frame, an elongated channel-shaped bracket 42 is secured to each side of the elliptic housing 40 by rivets and welding as best shown in Fig. 18. The portion of the bracket 42 next to the housing 40 is formed concave to snugly engage and fit the oval side of the housing 40. The ends 43 of the brackets are bent to extend outwardly at an angle from each end of the housing 40 to be received in kerfs 44 provided in the ends of the elliptic arms 2 and 36 for welding thereto. In the event these arms are made of a single piece of metal, the two flanges at the bottom of the section are welded to opposite sides of the flanges 43, and where these arms of the X-member are formed of two stampings as in Fig. 23, these stampings at their ends which unite to the housing 40 are left slightly spaced apart for the subsequent insertion of the flanges 43 and spot welding of the flanges 15 and 16 as at X to the bracket 43. In order to build up the torsional value of the joint between the arms of the X-member and the bracket 42 the top and bottom of this bracket is flanged as at 45 with the ends overlapping the top and bottom of the tubular arms 2 and 36 for welding thereto at suitable points such as indicated by the numeral 46.

There have been illustrated several modifications of forming the cross section of the side rails and cross members of the frames in Figs. 22, 23 and 24. In addition, the elliptic section in Fig. 22 may be provided without the flanges 5 and the free longitudinal edges of the single blank may be simply brought together and welded together. Also in Fig. 24, the top and bottom flanges of the two piece structure may both extend inwardly inside of the tubular structure instead of only one of them as at 12 extending outwardly.

Various forms of joints between the arms of the X-member 3 and the side rails as well as between the cross members and side rails have been illustrated and they will be described in the order of their numerical numbering.

In Fig. 11 one forward arm of the X-member 75

is designated by the numeral 36 and in order to connect this arm with the elliptic section side rail, a special bracket 50 is shown composed of an angular channel section having a web 51 and upper and lower flanges 52 and 53 respectively. The end of the X-member arm 36 is provided with a vertical longitudinal extending kerf to receive a portion of the web 51 for attachment of the same to the flanges 54 of the X-member arm by welding or riveting but preferably spot welding. In addition, the web 51 of the bracket is welded to the edges of the kerf in the end of the X-member arm 36. The upper and lower flanges 52 and 53 of this bracket bridge the crotch formed between the X-member arm and the side rail, as illustrated, to form effective gussets. Those portions of the web and flanges of the bracket which are contiguous to the inner side 13 of the side rail, are shaped to conform to the shape thereof for welding around its edges to the rail while the end edges of the flanges 52 and 53 abut the upper and lower flanges 15 and 16 of the side rail to be welded thereto, as best appreciated in Fig. 11a, at 52'.

In Figs. 12, 13 and 14 another modified form of bracket is illustrated as composed of a single stamping 55 with a portion 56 overlying the inner section 13 of the elliptic side rail and conformed to the shape thereof. The web portion 57 of this bracket is laid upon the exterior surface of the side rail, and at the point in alignment with the arm 36 of the cross member, is bent inwardly at an angle to be received in the kerf in the free end of the X-member arm as in the preceding modification. The upper and lower edges 58 of this bracket are formed inwardly to provide inwardly extending parallel flanges which gusset the joint between the side rail and X-member arm as shown. The bracket 55 is secured to the X-member arm in the same manner as the preceding modification and that portion which overlies the side rail may be welded around its edges to the side rail and additionally riveted as at 59.

Fig. 12a shows another modification of connecting the arms of the X-member with the elliptic side rails, in which case the ends of the X-member arms adjacent the rails are bent as at 60 to extend through openings 61 of the side rail and then parallel therewith in telescopic relationship. In this modification, the arms of the X-member would be preferably, but not necessarily, devoid of flanges 5 so as to nest snugly within the interior configuration of the elliptic side rails for welding or riveting thereto. In addition, an angled bracket 62 may be provided in the inner crotch between the rear portion of the X-member arm and the side rail and provided with horizontal flanges 63 to gusset the construction. This bracket may be riveted or welded along its margins wherever it contacts with the side rail and X-member arm.

In Fig. 12b a simpler form of connection is illustrated wherein the arms of the X-member would preferably be made up as in Fig. 23 from two stampings with upper and lower flanges 15 and 16 so that the ends of these members adjacent side rails can be spread apart as at 64 to form an integral forwardly extending foot 65 and a rearwardly extending one 66. The arms of the X-member being made identically the same as the side rail sections, it will be seen that the feet 65 and 66 of the arm 36 can snugly engage the inner arcuate section of the section 13 with the upper and lower flanges 15 and 16 of the arms 36 juxtaposed with respect to the corresponding flanges 15 and 16 of

the side rail so as to be welded thereto as at 67 and additionally welded around their margins to the inner web of the side rail. It will of course, be obvious that in both Figs. 12a and 12b the extension 60 and the feet 65 may be extended along the side rail as far as necessary to accomplish the effective joint between the members which will be high in torsion and shear value.

In Figs. 15, 16 and 17, a further modification of joint is illustrated in which a substantially angular bracket is provided from a web 70 bent at an acute angle, one leg 71 of which is welded or otherwise suitably secured to the inner stamping 13 of the side rail, while the other leg 72 fits into the kerf 73 of the end of the X-member arm and is welded thereto as in the preceding modifications. The upper and lower edges of the leg 72 are provided with upper and lower flanges 74 and 75 respectively, and extend at right angles to the plane of the leg 72 to form a gusset connection between the arm 36 and the side rail. The free edges of these flanges 74 and 75 extend to meet the upper and lower flanges 15 and 16 of the side rail for welding thereto as at 76. A portion of the leg 71 is pressed out into angularly extending tab 77 which parallels the inner wall of the side rail and is riveted at 78, welded or otherwise suitably secured thereto.

It is to be understood that any of the joints herein described may be used for connecting the arms of the X-member with the side rails or as a matter of fact, for connecting any of the straight transverse cross members with the side rails.

The third transverse straight cross member 79 of the frame of Fig. 1 assumes the form generally of an inverted channel-shaped member with each longitudinal edge provided with a laterally extending flange 80. The detailed manner of connecting this cross member with the side rails is shown in Figs. 6 and 7. It will be noted that the center of this cross member is dropped or offset and that each end of the cross member is formed to conform to the curvature of the inner side wall 13 of the side rail and is riveted thereto by means of rivets and also welded. The upper and lower edges of each end of this cross member extend to the bases of the flanges 15 and 16 of the side rail to be welded thereto as at 82. Each end of the cross member has its channel closed by means of a stamping 83 having a portion thereof fitting within the channel of the cross member 79 with the outermost edge of the stamping engaging the outer section 14 of the side rail at the base of the lower flange 16 so that this edge as well as the lower edge of the actual end of the cross member may be both welded to the side rail as at 84.

The rearmost straight transverse cross member 85 is also of inverted channel shape with its flanges provided with horizontal flanges 86. The detailed connection of the ends of this cross member with both side rails is shown in Figs. 26, 27 and 28 as well as the method of associating a rear spring hanger bushing 87 therewith. As seen in Fig. 28 the ends of this cross member are pressed to conform to the shape of the inner section 13 of the side rail so that the edges thereof may be welded as at 88 thereto. The spring hanger bushing 87 projects through both walls of the side rail and is circumferentially welded thereto around the openings through which it projects. In order to preclude deformation of these openings by the weight imposed upon the bushings, a heavier gauge stamping 89 similar to 39 of Fig. 2 and conforming to the interior configuration of the side rail is positioned therein. This reinforcement 89 is pro-

vided with tubular punched out portions 90 in its opposed walls for the reception of the bushing 87 so that all strains imposed upon the frame by the hanger bushing are uniformly distributed over the entire area of the cross section of the rail.

In Fig. 19 is shown a modified form of frame in which each rail is not formed by two pressed metal parts such as 13 and 14 throughout their entire length, but instead is formed from one outer stamping 90' continuous from one end of the frame to the other and having the same shape as the outer stamping 14 of the previously described rail with an upper flange 91 and a lower one 92. The tubular section of each rail is completed by providing three separate stampings 93, 94 and 95 of cross section corresponding to the section of stamping 90' so that the upper and lower flanges 96 and 97 of each can be spot welded or otherwise secured in juxtaposition to the upper and lower flanges 91 and 92 of the outer stamping 90', to form a substantially elliptic section for the rail such as shown in Fig. 23. Of course, other forms of stampings than those shown and described in this application can be used for the side rail to provide the seed-like cross sectional shape found so desirable. The length of the sections 93, 94 and 95 are such as to dispose their adjacent ends, when assembled into a side rail, adjacent the points of intersection therewith of the four arms 98 of an X-shaped cross member disposed at substantially the mid-section of the frame.

In order to form an effective torsion and shear resisting joint between this type of side rail and the four arms of the X-member, a stamping 99 is provided at each juncture of the sections 93, 94 and 95 of each side rail. Each stamping 99 as best shown in Figs. 20 and 21 consists of a channel-shaped bracket arranged with a vertical web 100 abutting the upper and lower flanges 91 and 92 of section 90' to be welded or otherwise suitably secured thereto. The adjacent small sections such as 93 and 94 forming the rail into tubular section are offset as at 101 to cause these ends to overlap the web 100 of the stamping for attachment thereto either by welding or riveting. Between the upper and lower horizontal flanges 102 of this stamping, is disposed an angularly extending integral part 103 which is adapted to enter the kerf in the end of the X-member arm 98. The ends of the tubular arms 98 of the X-member formed in any of the sections herein described and illustrated are brought into contact with the flanges 104 to overlap opposite sides of the flange 103 for welding thereto. It will be noted that the upper and lower flanges 102 of the stamping overlap the sections 93 and 94 of the side rail to be welded thereto as at 105 and also overlap the upper and lower portions of the elliptic section X-member arm to be welded thereto as at 106.

The housing forming the intersection of the four arms of the X-member is indicated, as in the preceding modification, by the numeral 40 and is of oval or elliptic section as in the preceding modification to provide ample propeller shaft clearance therethrough.

The two side rails of this frame may be additionally secured together by a front cross member 107 and two rear cross members 108 and 109 suitably welded and riveted to the inner sections of the elliptic side rails. The rearmost cross

member 109 and any of the others may be secured to the side rails by having its ends extended through opposite side walls of the side rails and welded to each of these side walls with a weld extending around the entire perimeter of the cross member. In this instance, both the rear cross members 108 and 109 are of any of the sections shown in Figs. 22 to 24 so as to have substantially the same cross sectional shape throughout their length as the side rails and arms of the X-member.

It is to be understood that various changes in the construction and arrangement of parts may be made without departing from the scope of the appended claims.

I claim:

1. A motor vehicle frame comprising a pair of substantially elliptic section side rails arranged with the major axis of the ellipses in vertical planes, a correspondingly shaped cross member having a vertical kerf in its end to be attached to the side rail, and said side rail having a gusseted angular extension received in and welded to the edges of said kerf and the vertical ends of the cross member embracing and being welded to said extension.

2. A motor vehicle frame comprising a pair of hollow side rails, a convex bracket conforming to the shape of the convex wall of the side rail and secured thereto, said bracket having an angularly extending foot, and a cross member connecting the rails and being formed from a pair of stampings secured together to form a hollow cross member adapted to embrace the foot of said bracket to be secured thereto.

3. A motor vehicle frame comprising a pair of side rails, a cross member of substantially elliptic section arranged with the major axis of the ellipse in a vertical plane, said cross member having a vertical slot in its end, and said side rail having an angular extension secured in the slot of the cross member.

4. A motor vehicle frame comprising a pair of side rails of elliptic section arranged with apices disposed on the major axis of the ellipses in vertical planes, cross members connecting the same, and said cross members having extensions shaped to conform to the shape of the elliptic rails and overlapping the same and secured thereto.

5. A motor vehicle frame comprising a pair of side rails of elliptic section arranged with their major axes vertical, a correspondingly shaped cross member having a vertical slot in its end to be attached to the side rail, and said side rail having a gusseted angular extension secured to said slot and the vertical ends of the cross member embracing and being welded to said extension.

6. A motor vehicle frame comprising a pair of side rails, a cross member of hollow section, said cross member having a vertical slot in its end, and said side rail having an angular extension secured in the slot of the cross member.

7. A vehicle frame comprising a pair of side rails of elliptic section arranged with their major axes vertical and having vertically disposed upper and lower flanges, brackets secured to said flanges and having angular extensions, and a cross member connecting the rails and having slots to receive said extensions.

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