July 3, 1951 J. W. VOTYPKA 2,559,482

FOLDING TOP CONSTRUCTION

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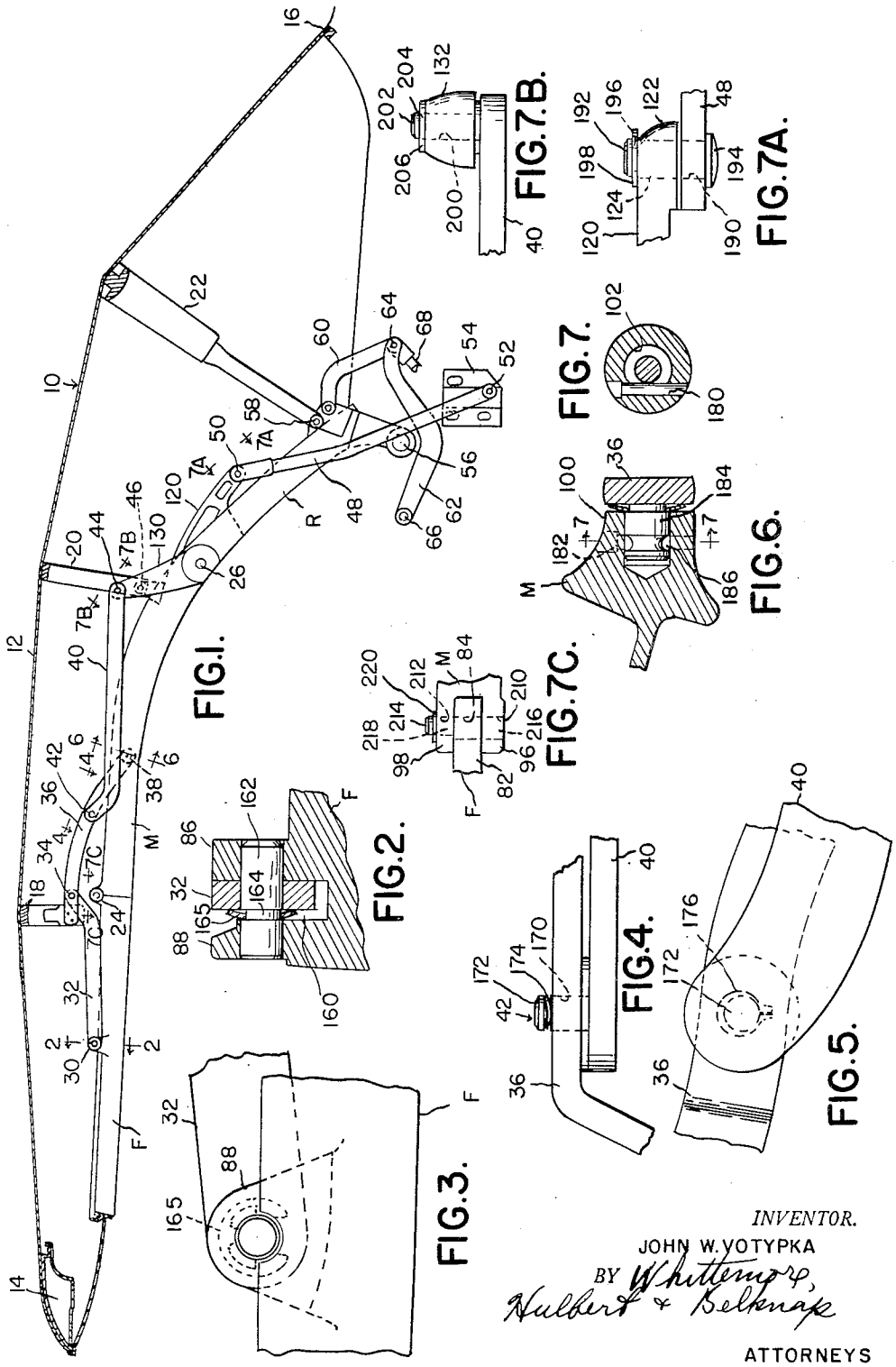


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 7A.

FIG. 7B.

FIG. 7C.

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FOLDING TOP CONSTRUCTION

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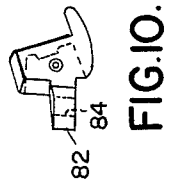


FIG.10.

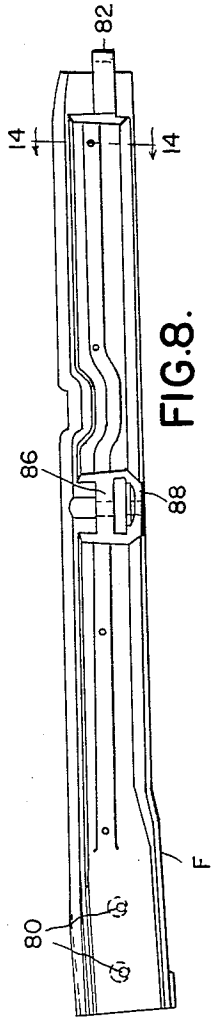


FIG.8.



FIG.9.

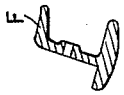


FIG.14.

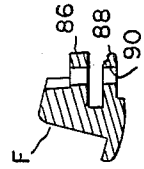


FIG.13.

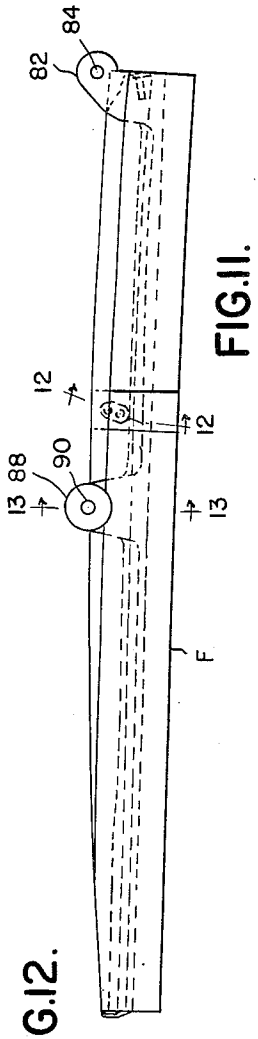


FIG.11.

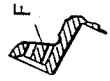


FIG.12.

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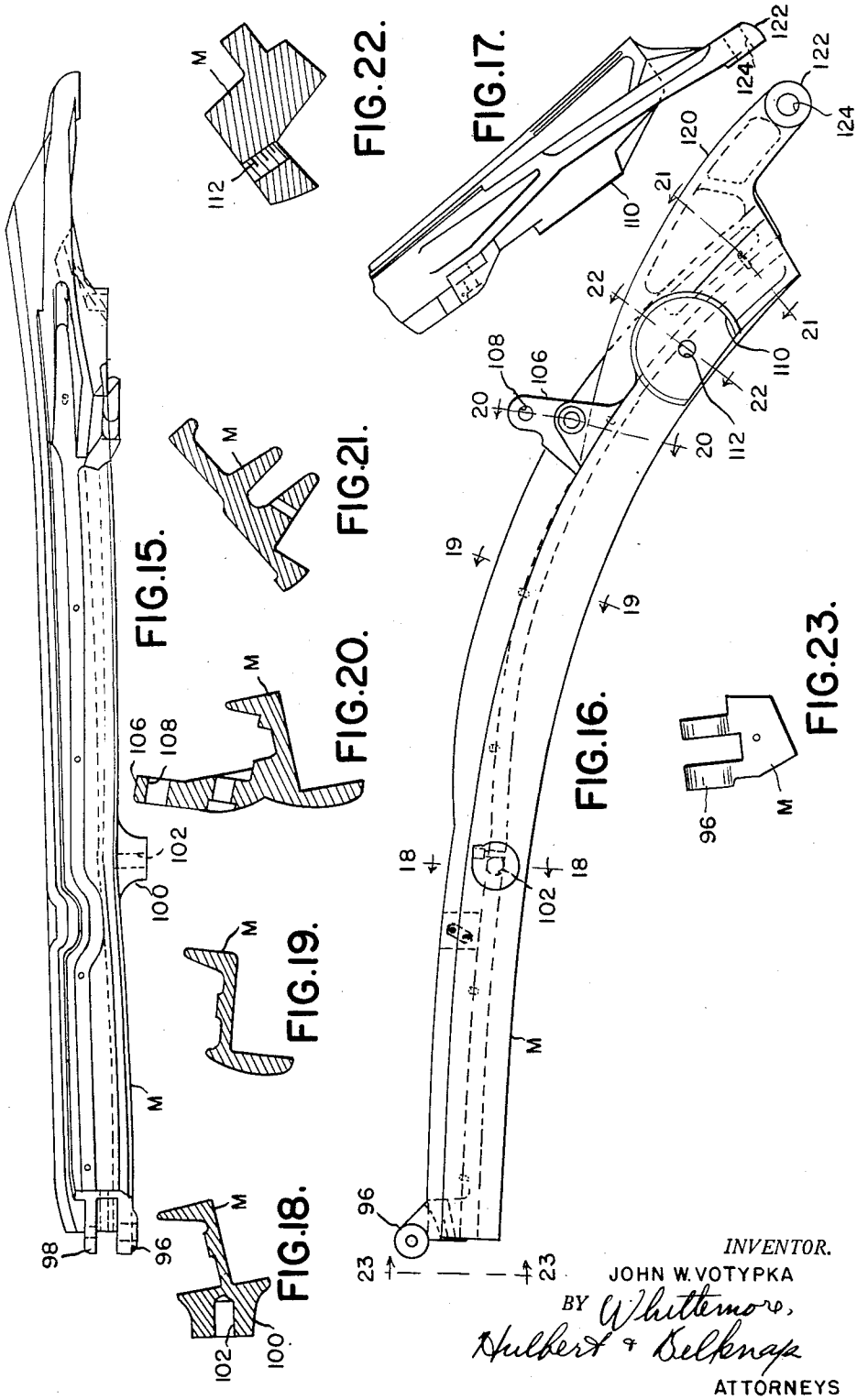
BY Whittemore Hulbert & Belknap

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FOLDING TOP CONSTRUCTION

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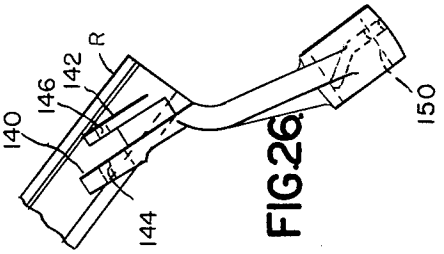


FIG.26.

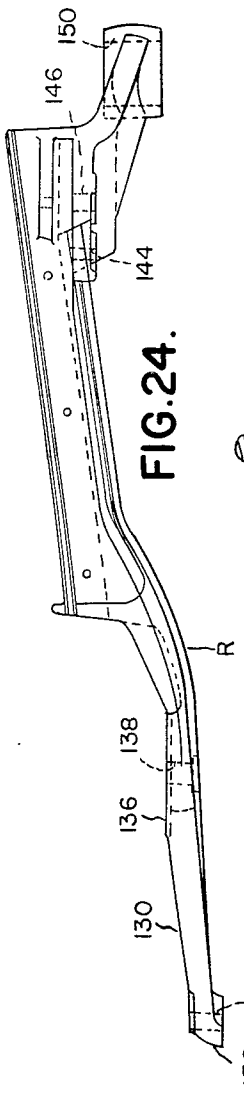


FIG.24.



FIG.27.

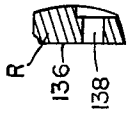


FIG.28.

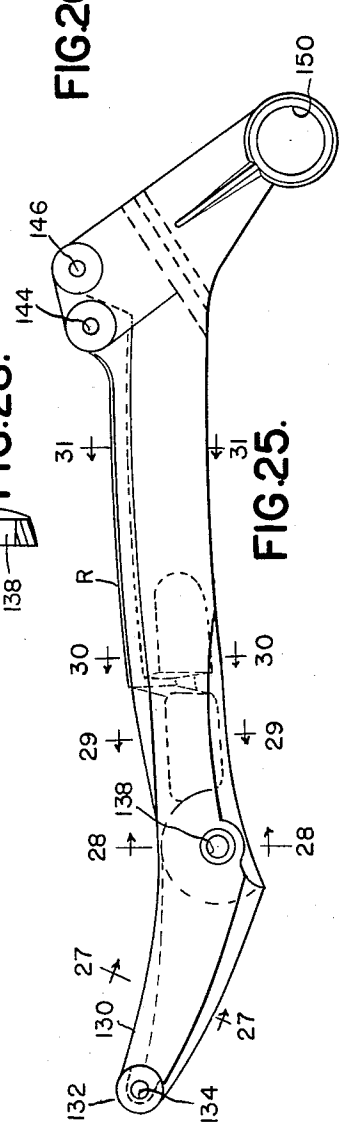


FIG.25.



FIG.31.

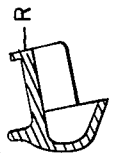


FIG.30.



FIG.29.

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UNITED STATES PATENT OFFICE

2,559,482

FOLDING TOP CONSTRUCTION

John W. Votypka, Detroit, Mich., assignor to Detroit Harvester Company, Detroit, Mich., a corporation of Michigan

Application July 11, 1949, Serial No. 104,089

8 Claims. (Cl. 296—116)

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The present invention relates to folding top construction and more particularly to an improved construction of links for effecting folding and unfolding of the top of a convertible vehicle.

It is an object of the present invention to provide an improved folding top construction characterized by the simplicity of the parts making up the linkage, by the substantial reduction in cost resulting from forming the major elements of the system from castings, and by the improved appearance of the construction resulting from the elimination of substantially all nuts and bolts previously used in assembly.

It is a feature of the present invention to provide a folding top construction comprising three major bars pivoted together in conjunction with a plurality of separate links, the bars being in the form of metal castings and provided with openings therethrough or recesses therein wherever a pivot joint is to be provided either between pairs of bars or between a bar and a separate link.

It is a further feature of the present invention to provide pivot connections between bars and links or between pairs of bars, characterized by the use of pins located in openings in the bars and retained against disassembly by pin engaging elements.

It is a further feature of the present invention to provide a construction of the type referred to in the preceding paragraph in which the pin engaging elements take the form of substantially flat resilient clips or pins engaging in circumferential recesses provided in the pins.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a fragmentary transverse longitudinal section through a portion of a vehicle top illustrated in extended position.

Figure 2 is an enlarged fragmentary section on the line 2—2, Figure 1.

Figure 3 is a fragmentary side elevation of the structure shown in Figure 2.

Figure 4 is a fragmentary side elevation looking in the direction of the arrows 4—4, Figure 1.

Figure 5 is a fragmentary side elevation of the structure shown in Figure 4.

Figure 6 is an enlarged fragmentary section on the line 6—6, Figure 1.

Figure 7 is a section on the line 7—7, Figure 6.

Figure 7A is a fragmentary plan view at arrows 7A, 7A, Figure 1.

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Figure 7B is a fragmentary plan view at arrows 7B, 7B, Figure 1.

Figure 7C is a fragmentary plan view at arrows 7C, 7C, Figure 1.

Figure 8 is a plan view of the front bar of the top construction.

Figure 9 is an end elevation of the bar looking from the left in Figure 8.

Figure 10 is an end elevation of the bar looking from the right in Figure 8.

Figure 11 is a side elevation of the bar shown in Figure 8.

Figure 12 is a fragmentary section on the line 12—12, Figure 11.

Figure 13 is a section on the line 13—13, Figure 11.

Figure 14 is a section on the line 14—14, Figure 8.

Figure 15 is a plan view of the middle or intermediate bar of the frame construction.

Figure 16 is a side elevation of the bar shown in Figure 15.

Figure 17 is a fragmentary plan view of the right hand end of the bar looking downward and to the left in Figure 16.

Figure 18 is a section on the line 18—18, Figure 16.

Figure 19 is a section on the line 19—19, Figure 16.

Figure 20 is a section on the line 20—20 Figure 16.

Figure 21 is a section on the line 21—21, Figure 16.

Figure 22 is a section on the line 22—22, Figure 16.

Fig. 23 is an end view of the bar looking from the left in Figure 16 as indicated by the arrows 23—23.

Figure 24 is a plan view of the rear bar of the top construction.

Figure 25 is a side elevation of the bar shown in Figure 24.

Figure 26 is a plan view of the right hand end of the bar as seen in Figure 25, looking downward and to the left in that figure.

Figure 27 is a section on the line 27—27, Figure 25.

Figure 28 is a section on the line 28—28, Figure 25.

Figure 29 is a section on the line 29—29, Figure 25.

Figure 30 is a section on the line 30—30, Figure 25.

Figure 31 is a section on the line 31—31, Figure 25.

Referring now to Figure 1 the folding top con-

struction illustrated generally at 10 comprises a fabric top 12 secured at its front end to a transverse front header bar 14 and at its rear end to a rear portion of the vehicle as indicated at 16. Intermediate the front and rear end of the top fabric 12 are a plurality of cross bows 18, 20 and 22. The linkage for controlling extension and folding of the top comprises a front bar or rail F, a middle or intermediate bar or rail M, and a rear bar or rail R commonly referred to as the pillar rail. The details of construction of the bars F, M and R will be given in conjunction with a description of succeeding figures, but for the present purpose it should be observed that the rear end of the front bar is pivoted to the front end of the intermediate bar at 24, and the rear end of the intermediate bar is pivoted to the front end of the rear bar at 26. Pivoted intermediate the front bar F as indicated at 30, is a cross bow controlling link 32. The rear end of the link 32 is pivotally connected as indicated at 34 to a second cross bow controlling link 36, to one end of which the cross bow 18 is secured. The link 36 at its rear end is pivoted to an intermediate portion of the intermediate bar M, this pivot connection being indicated at 38. A third cross bow controlling link 40 is pivoted at its forward end as indicated at 42 to an intermediate portion of the link 36. The link 40 is pivoted at its rear end as indicated at 44 to the forward end of the rear bar R. The bars or rails F, M and R are basically of one-piece construction, preferably metal castings, and cooperate to form a continuous side rail which is pleasing in appearance. The surface of the rail exposed at the interior of the vehicle is a smooth continuous surface. Moreover, due to their structural features, the bars cooperate with the actuating linkage, provide lateral webs which permit effective weather sealing, and strongly resist torsion.

The intermediate cross bow 20 is pivoted as indicated at 46 to an intermediate portion of the intermediate bar M. A guide link 48 is pivoted to an arm at the rear end of the intermediate bar M as indicated at 50, the opposite end of the link 48 being pivoted to a fixed pivot point 52 carried on a bracket 54.

The rear end of the rear bar R is pivoted to a fixed pivot point indicated at 56 in the vehicle. Intermediate its ends the rear bar R has pivoted thereto the rear cross bow 22, the pivot connection for this being indicated at 58. Moreover, adjacent the pivot point 58 the rear bar R has pivoted thereto a control link 60, the other end of which is pivoted to a guide link 62 as indicated at 64, the other end of the guide link 62 being pivoted as indicated at 66 to a fixed pivot point.

Power means are provided for extending and folding the top construction and comprises a rod 68 which may be connected to a suitable source of power such for example, as an hydraulic cylinder or the like.

The present invention is concerned with improving the appearance and reducing the cost of the linkage just described. Previously, the bar members which are necessarily of rather complicated shape, were assembled together from a plurality of parts and were thus relatively expensive to produce and also were unsightly in appearance. This was particularly true since the method of providing pivot connections between the several bars and between the bars and the associated links was to employ bolts

threaded into one of the parts, and in some cases through bolts extending through openings in the parts and retained in assembled relation by nuts.

According to the present invention the pivot connections have been substantially simplified by providing for pins to establish the pivot connection, these pins being retained in place by pin retaining elements which are either housed within the linkage structure or which are substantially flat and relatively thin and lie closely adjacent to one of the link elements, thus reducing the amount by which the pivot pin extends outwardly from the link element.

Referring now to Figures 8–14 the detailed shape and construction of the front bar F is illustrated.

The bar F is a single unitary casting and at its forward end is provided with openings 80 by means of which the front ends of the bar are secured to the front header bar 14. At its rear end the bar F is provided with a single upstanding integral ear 82 having a pin receiving opening 84 therein. Intermediate its ends as best seen in Figure 13, the bar F is provided with a pair of spaced ears 86 and 88 provided with aligned pin receiving openings 90 therein.

Figures 12, 13 and 14 show the cross sectional shape of the bar F at the points indicated.

Referring now to Figures 15–23 the middle or intermediate bar M is illustrated in detail. This bar at its forward end is provided with a pair of spaced ears 96 and 98 which are adapted to receive therebetween the ear 82 formed at the rear of the front bar F. In addition, the bar M is provided with a laterally extending boss 100 having a recess 102 for establishing the pivot connection 38 at the rear end of the cross bow link 36. Also intermediate its ends but spaced rearwardly from the boss 100 is an upstanding flange 106 having an opening 108 therein for receiving the pin which establishes the pivot 46 for the cross bow 20.

Adjacent its rear end the bar M is provided with a boss 110 having a threaded opening 112 therein for receiving a pivot pin for establishing the pivot connection 26 between the intermediate bar M and the rear bar R.

At its rear end the intermediate bar M has an arm 120 terminating in an ear 122 apertured as indicated at 124 for receiving a pin establishing the pivot connection 50 with the control link 48.

The transverse shape of the bar M is as indicated in the sectional views 18, 19, 20, 21 and 22.

Referring now to Figures 24–31 there is illustrated the detailed construction of the rear bar R. At its forward end the bar R has an upwardly extending arm 130 terminating in an ear 132 provided with an aperture 134 for receiving a pin constituting the pivot connection 44 with the link 40.

Adjacent its forward end the bar R is provided with a flattened portion 136 apertured as indicated at 138 for receiving a bolt threaded into the threaded recess 112 in the intermediate bar M for establishing the pivot connection 26.

Adjacent its rear end the bar R is provided with a pair of upstanding flanges 140 and 142 (Figure 26), each of which is apertured to provide openings 144 and 146 respectively. The opening 144 receives a pin to establish the pivot connection 58 with the cross bow 22. The opening 146 receives a pin to establish a pivot connection with control link 60 as well illustrated in Figure 1.

At its rear end the rear bar R is provided with

an enlarged eye 150 which is pivoted to a stud constituting the pivot connection 56.

The cross sectional shape of the bar R is as indicated in the sectional views of Figures 27, 28, 29, 30 and 31.

Referring again to Figure 1 and to Figures 2–7 inclusive, there is illustrated the detailed means employed to establish several of the pivot connections. As seen in Figures 2 and 3 the end of the link 32 is received between the ears 86 and 88, the ears being spaced apart to provide clearance as indicated at 160. The pivot connection 30 is established by the pin 162 which is provided with a circumferential groove or recess 164. To retain the pin 162 in assembled relation with the bar F and the link 32 a resilient retainer 165 is employed. This retainer is substantially flat and of generally C-shape and is adapted to snap over the reduced groove section of the pin 162 so as to prevent axial movement thereof. It will be observed that with the retainer 165 in place the pin is effectively retained against displacement while at the same time no unsightly projecting bolt is required.

Referring now to Figures 4 and 5 the pivot connection 42 between the links 36 and 40, is illustrated. In this case the link 36 is provided with an opening 170 intermediate its ends and the link 40 is provided with an integral pin like stud 172 adjacent its forward end. The pin 172 is provided with an annular groove 174 adjacent its free end for the reception of a pin retainer 176. While the pin retainer 176 could if desired, be similar to the retainer 165 illustrated in Figures 2 and 3, in this instance there is illustrated a somewhat different type of retainer. The retainer 176 is resilient but instead of being C-shaped is shaped to envelope substantially 360 degrees of the pin 172. It is however resilient and may be removed in a radial direction. It will be observed that the pivot connection thus established is very simple and avoids the use of threaded fastener elements such as bolts, nuts or the like.

Referring now to Figures 6 and 7 there is illustrated the detailed construction of the pivot connection 38 between the rear end of the link 36 and an intermediate portion of the intermediate bar M. In this instance the bar M is provided with the boss 100 in which is formed the recess 102. Extending transversely of the recess 102 is the opening 180 for receiving the pin 182. The link 36 has formed thereon an integrally projecting pin or stud 184 having an annular groove 186 formed adjacent its end. The pivot connection 38 is established by inserting the pin 184 into the recess 102 so as to bring the annular groove 186 into alignment with the pin receiving opening 180. At this time the pin 182 may be inserted and will have a side portion received within the groove 186, thereby effectively preventing removal of the pin 184. Obviously of course, when it is desired to disassemble the parts, the pin 182 is removed after which the pin 184 may be withdrawn from the recess.

Referring now to Figure 7A there is illustrated the detailed construction of the pivot connection between the intermediate bar M and the guide link 48. The intermediate bar M, as previously described, is provided with a rearwardly extending arm 120, the end of which is provided with a head 122 apertured as indicated at 124. The end of the link 48 is provided with an aperture 190 for the reception of a pivot pin 192. The pivot pin is provided with a thin head 194 and adjacent its opposite end is provided with a shallow annular groove 196. A resilient clip type pin retainer 198 is provided which is adapted to spring in place and be seated in the groove 196 to retain the pin in assembled relation as illustrated. It will be observed that the pivot connection thus provided is characterized by the fact that the pivot pin extends beyond opposite sides of the pivoted members by a minimum amount, and further, that a permanent securing means is provided therefor which will not become loosened by vibration during usage.

Referring now to Figure 7B there is illustrated the details of the pivot connection at 44 between the link 40 and the forwardly projecting arm 130 on the rear bar R. The forwardly projecting arm 130 on the rear bar R has an ear 132 provided with a through opening 200. At the rear end of the link 40 there is an integral pin 202 which is provided adjacent its free end with an annular groove 204. The pin 202 extends completely through the opening 200 to expose the channel or groove 204 therebeyond. A resilient pin retainer 206 which may be of the type illustrated at 165 in Figures 2 and 3, is seated in the groove 204 and serves to retain the parts in the assembled relation illustrated in the figure.

Referring now to Figure 7C the detailed construction of the pivot connection at 24 between the front bar F and the intermediate bar M is illustrated. As previously described, the front bar F has at its rear end an apertured ear 82 which extends between a pair of forwardly extending apertured ears 96 and 98 on the forward end of the intermediate bar M. The opening or aperture 210 in the ear 96 is larger than the corresponding aperture 212 in the ear 98. As illustrated, the aperture 84 in the ear 82 is of the same size as the aperture 210. A pivot pin 214 is provided having an enlarged portion 216 located within the apertures 210 and 84 and a reduced portion 218 located within the aperture 212. The pin 214 is thus provided with a shoulder which bears against the inner surface of the ear 98 and prevents axial movement of the pin in an upward direction as shown in Figure 7C. The portion of the pin 214 which projects beyond the ear 98 is provided with a reduced groove for the reception of a resilient pin retaining clip 220 which may be of the type illustrated at 165 in Figures 2 and 3.

It will be observed that the three main bars F, M, and R are each in the form of castings and are so constructed and arranged that at every pivot point thereon, there is provided an opening or recess for the reception of a pin like pivot element. This greatly simplifies the construction of the bars and avoids the necessity of attaching separate pivot forming elements thereto, as was previously required. The castings may definitely be produced at substantially lower cost than previous structure. Moreover, the provision of the pin receiving openings in the cast linkage bars permits the use of resilient pin retaining elements which occupy less space than the previously employed fastening bolts and which eliminate the unsightly projecting portions of such bolts. There is thus provided a folding top structure which contains all of the desirable operating features of previously known constructions and which is improved thereover both in appearance and cost. The parts are readily assembled and disassembled, while at the same time there is no tendency for threaded fastening elements to work loose due to vibration. Instead,

the resilient pin retaining elements operate efficiently to retain the pins indefinitely in assembled position at the various pivot points.

The production of the bars F, M and R as unitary one-piece members offers many important advantages. Prior to the present invention, parts corresponding to the bars were sub-assemblies composed of several pieces bolted or riveted together. Tolerances necessary to permit the sub-assembly of the component parts were in some cases cumulative with the result that overall tolerances were difficult if not impossible, to hold. As a result the actual assembly of the top required adjustment and fitting of the bars into the complete assembly. This same consideration rendered it impossible from a practical standpoint to make the bars freely interchangeable. This in turn resulted in the requirement that the folding top constructions be assembled where produced and they could not be shipped in knocked down condition.

By forming the bars F, M and R as unitary one-piece castings, dimensions are duplicated without error and extremely close tolerances can be obtained. Accordingly, the bars are freely interchangeable and the parts can be assembled in knocked down condition.

It is also found that by forming the bars of one-piece construction, and particularly where they are light metal castings, the overall weight of the folding top is substantially reduced. In practice a reduction in weight from 65 pounds to 45 pounds is obtained.

Moreover, due to the fact that the labor involved in completing the sub-assembly is eliminated, the overall cost of the top is reduced substantially in half.

Another important advantage of the one-piece unitary bars is that the parts may be made extremely rigid and by providing angularly disposed webs, the bars are capable of strongly resisting torsion. This is an important advantage in the present bars inasmuch as present day top construction often requires that the hinge connections between the several bars, the hinge mountings of the rear bar to the body of the vehicle, and the pivot connection between the bars and the actuating linkage must be out of alignment. This results in setting up torque on the bars which the unitary cast bars are designed to resist most effectively.

In general, the three bars making up the side rail assembly may be considered as comprising a main rail-forming portion provided with one or more offset arms by means of which adjacent bars are interconnected or to which actuating linkage is connected. The main rail-forming portions of the several bars are adapted to come into end abutment when the top is extended so as to produce a continuous side rail.

In particular, the bar F with the exception of the offset arm or ear 82, enters into the formation of the side rail assembly. The upstanding ears 88 of course project above the main rail-forming portions as seen in Figure 11. The right hand end of the bar F, as seen in Figure 11, is adapted to abut against the forward end of the bar M.

The bar M constitutes a main rail-forming portion to which are added the offset ear or arm 96 at one end, and the offset arm 120 at the opposite end. The upstanding arm 106 is provided intermediate the ends of the main rail-forming portion. The bar M is provided adjacent the rear end of its main rail-forming portion with the boss 110. The rear or pillar bar R, as best seen in Figure 25, comprises an intermediate portion which is the main rail-forming portion. At its forward end it includes a laterally offset and upwardly extending arm 130 having a flattened portion 136 provided with the openings 138, which cooperates with the boss 110 on the bar M to form the pivot connection between these two bars. It will thus be noted that the pivot connection between the rear or pillar bar and the intermediate bar is located forwardly from the forward end of the main rail-forming portion of bar R, and forwardly of the main rail-forming portion of the bar M. Moreover, the bar R at its rear end includes an offset arm carrying the pivot support or enlarged eye 150, by means of which the bar is pivoted to a fixed point on the body of the vehicle.

With the foregoing construction it will be observed that each of the three bars, F, M, and R, includes a main rail-forming portion, and that the end or ends of the rail-forming portions of each bar is in abutment with the adjacent end of a rail-forming portion of an adjacent bar. This is rendered possible by the fact that the pivot connections between the several bars in every case includes an arm offset from the rail-forming portion.

The drawings and the foregoing specification constitute a description of the improved folding top construction in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. In a folding top construction for a vehicle a side rail assembly comprising a front bar, an intermediate bar and a rear bar; each of said bars being of unitary one-piece construction; said rear bar having a main rail-forming portion intermediate its ends, an offset arm at its rear end for pivot connection to a fixed point on the vehicle, and an offset arm at its forward end, a first pivot connection intermediate the ends of the last named arm for connection to said intermediate bar, and a second pivot connection at the free end of the last named arm for connection to an actuating link; said intermediate bar having a main rail-forming portion, a pivot connection spaced forwardly from the rear end of said rail-forming portion for connection to said first pivot connection, an offset arm at the rear of said intermediate bar for connection to a guide link, and an offset pivot connection at its forward end for connection to said front bar; said front bar comprising a main rail-forming portion having an offset pivot connection at its rear end for connection to the pivot connection at the forward end of said intermediate bar, the main rail-forming portions of all of said bars arranged to come into end abutment upon extension of said top to form a substantially smooth continuous side rail.

2. Structure as defined in claim 1 in which each of said main rail-forming portions comprises a first web occupying a vertical plane, and a second web extending outwardly from said first web, said second webs providing a continuous top and rear surface cooperating with windows of the vehicle to form a weather-tight construction.

3. Structure as defined in claim 2, the main rail-forming portions of said bars comprising third webs at the side of said second web opposite said first web to stiffen said bars and particularly to prevent torsion thereof.

4. In a folding top construction for a vehicle, a side rail assembly comprising a front bar, an intermediate bar, and a rear bar, each of said bars being of unitary one-piece construction and comprising a main rail-forming portion having an inner web positioned in a vertical plane and a transverse web extending outwardly from said inner web, pivot means connecting the ends of said intermediate bar to the adjacent ends of said front and rear bars, said pivot means comprising arms offset laterally from said main rail-forming portions and located to bring the adjacent ends of the main rail-forming portions of said bars into abutment when the top is extended, said inner webs forming a continuous smooth surface visible from the interior of the vehicle, and said transverse webs forming a continuous seat for coaction with the top and rear edges of the vehicle windows to effect a weather-tight seal.

5. Structure as defined in claim 4 in which one of said pivot means is constituted by a pair of arms each of which is laterally offset from the main rail-forming portion of its bar and means pivotally interconnecting said pair of arms.

6. Structure as defined in claim 4 in which one of said pivot means comprises an arm laterally offset from the main rail-forming portion of one of said bars and projecting beyond the end of said main rail-forming portion, and means pivotally connecting said arm to the side of the main rail-forming portion of the next adjacent bar.

7. Structure as defined in claim 5 in which said arm has a pivot connection at the free end thereof for connection to a bar-controlling link.

8. Structure as defined in claim 4 in which said rear bar includes an arm laterally offset from the main rail-forming portion thereof and projecting beyond its rear end, said arm having a pivot connection for attachment to a fixed support on the vehicle.

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