Dec. 13, 1938. H. T. WOOLSON 2,139,788

METHOD OF MAKING STRUCTURAL BEAM MEMBERS

Filed Jan. 2, 1937

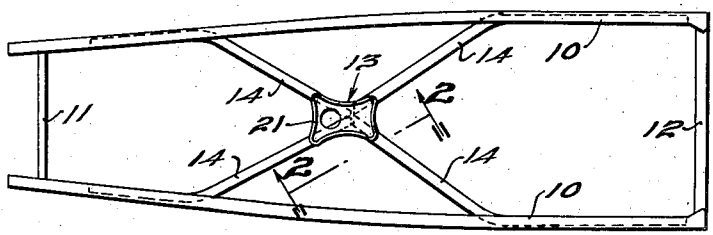


FIG. 1.

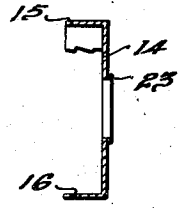


FIG. 3.

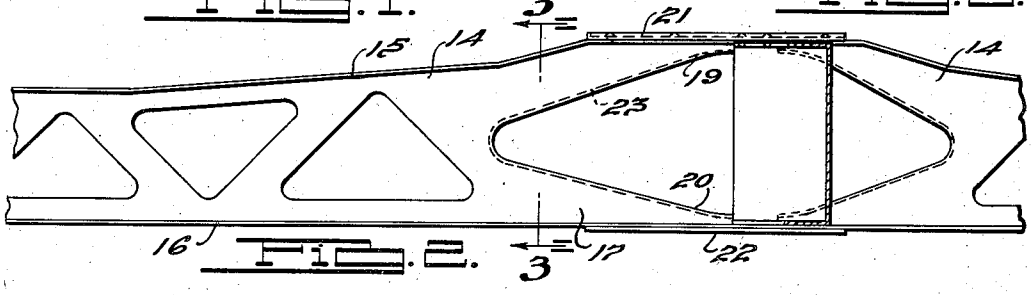


FIG. 2.

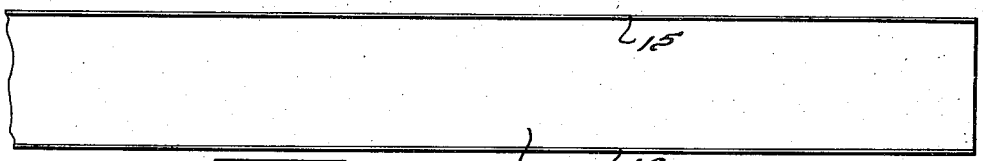


FIG. 4.

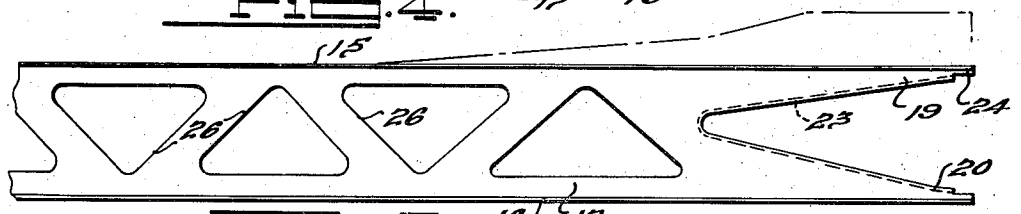


FIG. 5.

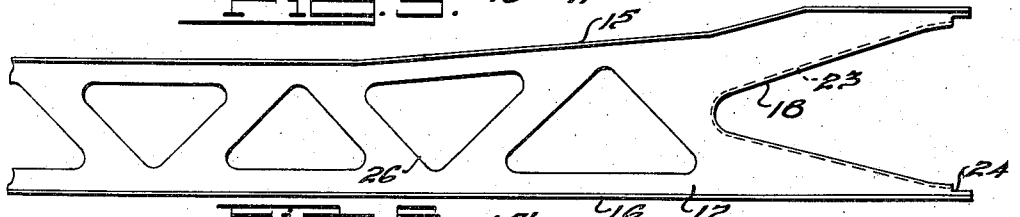


FIG. 6.



FIG. 7.

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METHOD OF MAKING STRUCTURAL BEAM MEMBERS

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8 Claims. (Cl. 29—155)

This invention relates to an improved structural beam member and the method of forming the same.

An object of the invention is to provide an improved structural beam member having a maximum rigidity and resistance and which represents a substantial reduction in weight and material over conventional structures. More specifically, the invention has for its object the provision of a member of this type especially adapted for use in vehicle frames for motor vehicles.

Another object of the invention is the provision of an improved method for forming a beam member of the class described from a piece of stock in which method the stock is perforated in such a manner as to accommodate and facilitate expansion for increasing the height and strength of the beam without diminution of the thickness thereof; and to provide an improved method which will result in a saving of material required for the finished product with a resultant gain in strength for a given weight and size of stock.

More specifically the invention has for one of its objects the provision of improved means for forming a channel-shaped beam member for a vehicle frame structure wherein the web portion of the channel member is expanded transversely for increasing the distance between the neutral axis of the beam member and the flange or flanges thereof without a substantial diminution of the thickness of the web.

An additional feature of my invention resides in the provision of an improved X-brace structure for a motor vehicle frame.

Other objects and advantages of the invention will be more apparent from the following description taken in connection with the accompanying drawing, in which:

Fig. 1 is a plan view of a vehicle frame structure embodying the invention.

Fig. 2 is a vertical sectional view taken on the line II—II of Fig. 1.

Fig. 3 is a vertical sectional view taken on the line III—III of Fig. 2.

Fig. 4 is a fragmentary side elevational view of a piece of stock or blank from which one of the frame members is formed by my improved method.

Fig. 5 is a fragmentary side elevational view of the stock or blank after the same has been perforated.

Fig. 6 is a fragmentary side elevational view of the stock shown in Fig. 5 after the same has been expanded transversely.

Fig. 7 is a view similar to Fig. 6 but showing a modified form of the invention wherein both vertical spaced projections at one end of the stock have been spread together with the adjacent portion of the stock, the full lines indicating the finished product and the dot and dash lines the contour of the stock prior to expansion.

The invention is illustrated and described in connection with a channel shaped brace or beam member for a vehicle frame structure wherein it has been found particularly adapted although it will be understood that the invention in its broader aspects is not to be limited to this embodiment.

Referring to the drawing there is shown a vehicle frame structure including spaced longitudinally extending side rails 10 connected at their adjacent ends by cross members 11 and 12. The rails 10 are connected by an X-bracing structure 13 positioned intermediate the ends thereof and substantially at the longitudinal center thereof. The structure 13 comprises four diagonally extending brace or beam members 14, the outer ends of which are attached to a side rail 10 and the opposite or inner ends thereof converge toward a central point approximately in the vertical longitudinal mid-plane of the frame structure. Each of the legs 14 is channel-shaped, having upper and lower flanges 15 and 16 respectively and an intermediate web 17. The inner ends of each brace 14 is cut away as at 18 forming upper and lower projections 19 and 20, respectively, the cut away portions 18 being adapted to accommodate a vehicle propeller shaft (not shown). The upper projections 19 of the legs 14 are rigidly united by a top plate 21 and the lower projections 20 are similarly secured together by a bottom plate 22. The inner ends of the legs 14 have a greater height than the main body thereof, as is illustrated in Fig. 2, and are provided with flat upper and lower surfaces at the end portions of the projections 19 and 20 to accommodate the respective securing plates, the upper edge of the brace being tapered from the flat surface in the direction of its outer end.

The periphery of the cut away portion 18 is bent in a direction opposite to the flanges 15 and 16 to provide a flange 23 for further increasing the rigidity and torsional resistance of the inner end portion of the brace member. To facilitate assembly, the web 17 and flange 23 of each brace 14 is relieved as at 24. In the X-type of frame bracing it is well-known that the torsional stresses are largely directed to and resisted mainly at the point of union of the inner or converging ends of the bracing members. By increasing the height of the brace and flanging the web as at 23,

provision is made for accommodating the propeller shaft of the vehicle and at the same time the requisite strength is provided for successfully resisting torsional stresses.

A structural member of the type illustrated has a neutral axis substantially midway between the flanged longitudinal edges and the resistance strength of the member to bending is to a large extent determined by the distance between this neutral axis and the center of gravity of the flanges 15 and 16. Where this distance is increased without a substantial diminution in the thickness of the web portion the resistance strength of the member is correspondingly increased.

One of the objects of this invention is to provide an improved method for forming a member of the class described which will have the requisite strength while maintaining the size and weight of the material requirements at a minimum. In carrying out the invention a strip of substantially flat stock of a given weight and dimension is provided and the longitudinal edges thereof are bent by any suitable means to form the flanges 15 and 16 having the intermediate web 17, as illustrated in Fig. 4. The flanging operation is performed preferably prior to the following enumerated operations for the reasons that the presence of the flanges aids such operations, although if desired the flanging operation may be performed subsequent thereto. The web 17 is perforated by cutting away portions thereof to form spaced openings 26 overlapping longitudinally of the web, these openings being illustrated as triangular but it will be understood that openings of other shapes, such as rectangular, may be provided and the invention is not to be limited to the particular shape of the openings or the manner in which they are formed. A section of the web at one end portion thereof is also removed, as at 18, forming the vertically spaced longitudinally extending upper and lower projections 19 and 20 when forming the particular beam members illustrated. The edge of the metal defining the opening 18 is bent in a direction opposite to the flanges 15 and 16 to form the flange 23. At the end of the above operations the articles appear as illustrated in Fig. 5.

The height and resistance to bending of the article are next increased by expansion of the web transversely by any suitable means, the perforations 26 accommodating and facilitating this expansion by which the distance from the neutral axis to the flanges 15 and 16 is increased without substantial diminution of the thickness of the web 17. The expanding operation does not alter the horizontal position of the lower longitudinal flange 16 and the projection 20 of the beam, but the upper projection 19 and a portion of the flange 15 adjacent thereto are deflected from the plane of the stock and provided with a taper, from the flat surface accommodating the plate 21, in the direction of the opposite end of the beam. The web 17 is expanded cold thus avoiding heating thereof with a resulting change in the texture and general physical properties of the material. The beam is then relieved at 24, although this operation may, if desired, be performed in a different order. The finished product is illustrated in Fig. 6.

A modified form of beam member is illustrated in Fig. 7 wherein the full lines represent the finished product and the dot and dash lines the stock prior to expansion thereof. In this form of the invention the longitudinal edges of the stock are bent to form flanges 15' and 16' having an intermediate web 17'. Portions of the web are removed to form spaced openings 26' overlapping longitudinally of the stock, and another portion is removed as at 18' to provide vertically spaced projections 19' and 20'. The periphery of the opening 18' is bent to form the flange 23'. The foregoing operations are similar to those described in connection with the finished article illustrated in Fig. 6.

In the form of the invention illustrated in Fig. 7, the web 17' is expanded in such a manner that the flanges 15' and 16' adjacent the projections 19' and 20', and the latter projections are deflected from the plane of the stock providing a beam member having the upper and lower flat surfaces for accommodating the plates 21 and 22, respectively, and a taper of both longitudinal edges from the flat surfaces extending toward the opposite end of the beam. It will be understood that the extent of the tapered portion of the product illustrated in both Figs. 6 and 7 may be varied to suit conditions.

Practice of both forms of the method herein illustrated results in increasing the strength of the member while maintaining the weight and size of the blank stock to a minimum. By increasing the height of the stock there is an increase in strength for a given weight and size.

Obviously, if desired, one of the longitudinal marginal flanges may be omitted but both flanges are ordinarily preferred for added rigidity. Also, the depth of the beam may be increased as aforesaid entirely to one side of the neutral axis instead of at both sides.

Although but several specific embodiments of the invention have herein been shown and described, it will be understood that various changes in the size, shape and arrangement of parts may be made without departing from the spirit of my invention.

I claim:

1. The method of forming a structural beam member from a strip of flanged stock comprising removing portions of the web to provide spaced triangular openings overlapping longitudinally of the beam to accommodate and facilitate relative separation of said flanges, and relatively separating said flanges for increasing the height of the beam.

2. The method of forming a structural flanged beam member from a strip of substantially flat stock consisting in bending opposite longitudinal edges of the stock to form the flanges of the beam with an intermediate web portion, and perforating the web portion in such a manner as to provide a pair of vertically spaced longitudinally extending projections at one end portion of said beam and to accommodate and facilitate relative separation of said flanges and said projections, and relatively separating said flanges and said projections for increasing the height of the beam.

3. The method of manufacturing a flanged structural beam member from a piece of stock having flanged longitudinally extending edge portions and a web therebetween, which comprises cutting away portions of the web to provide openings overlapping longitudinally of the beam thereby forming obliquely extending legs integral at their ends with the web, adjacent legs being oppositely inclined with respect to said flanges, and relatively separating said flanges for increasing the distance therebetween.

4. The method of manufacturing a flanged

structural beam member from a piece of stock having flanged longitudinally extending edge portions and a web therebetween, which comprises cutting away portions of the web to provide openings overlapping longitudinally of the beam thereby forming obliquely extending legs integral at their ends with the web, adjacent legs being oppositely inclined with respect to said flanges, and moving at least one of said flanges relative to the other in a path at right angles with respect to the longitudinal axis of the beam for increasing the depth of the latter.

5. The method of manufacturing a flanged structural beam member from a piece of substantially flat stock which comprises bending opposite longitudinal edges of the stock to form the flanges of the beam, with an intermediate web, cutting away and removing portions of said web to facilitate relative separation of said flanges, and moving at least one of said flanges relative to the other in a path at right angles with respect to the longitudinal axis of the beam for increasing the depth of the latter.

6. The method of forming a structural flanged beam member from a piece of stock of substantially uniform height throughout its length and having flanged longitudinally extending edge portions and a web therebetween which comprises removing poritons of said web at an end portion thereof in such a manner as to provide a pair of vertically spaced longitudinally extending cantilever arms and to facilitate relative separation of said flanges along said cantilever arms and in a region adjacent said arms, and relatively separating said flanged edge portions along said arms and at said region adjacent thereto for increasing the vertical spacing of said arms and to provide a beam progressively increasing in height at said region in a direction towards the separated arms.

7. The method of manufacturing a vehicle frame X-brace component arm having an open attaching portion from a strip of substantially flat stock comprising, bending opposite longitudinal edges of the stock to form the flanges of said beam with an intermediate web, removing portions of said web in such a manner as to provide a pair of vertically spaced longitudinally extending cantilever attaching arms and to facilitate relative separation of said flanges along said cantilever arms and in a region adjacent said arms, and relatively separating said flanges along said arms and at said region adjacent thereto to increase the vertical spacing of said arms for accommodating a vehicle propeller shaft therebetween and for increasing the distance between said flanges in said region.

8. The method of forming a flanged component arm of a vehicle frame X-brace structure from a piece of stock of substantially uniform height throughout its length and having flanged longitudinally extending edge portions and a web therebetween which comprises, removing a portion of said web at an end portion thereof to provide a pair of vertically spaced longitudinally extending cantilever attaching arms and an opening therebetween adapted to accommodate a vehicle propeller shaft, flanging the wall of said web bounding said opening, and relatively separating said arms for increasing the size of the opening therebetween.

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