Sept. 18, 1962 H. A. DE LA RAMBELJE 3,054,486

FORM SUPPORTING GIRDER FOR USE IN CONCRETE CONSTRUCTION

Filed June 29, 1961 2 Sheets-Sheet 1

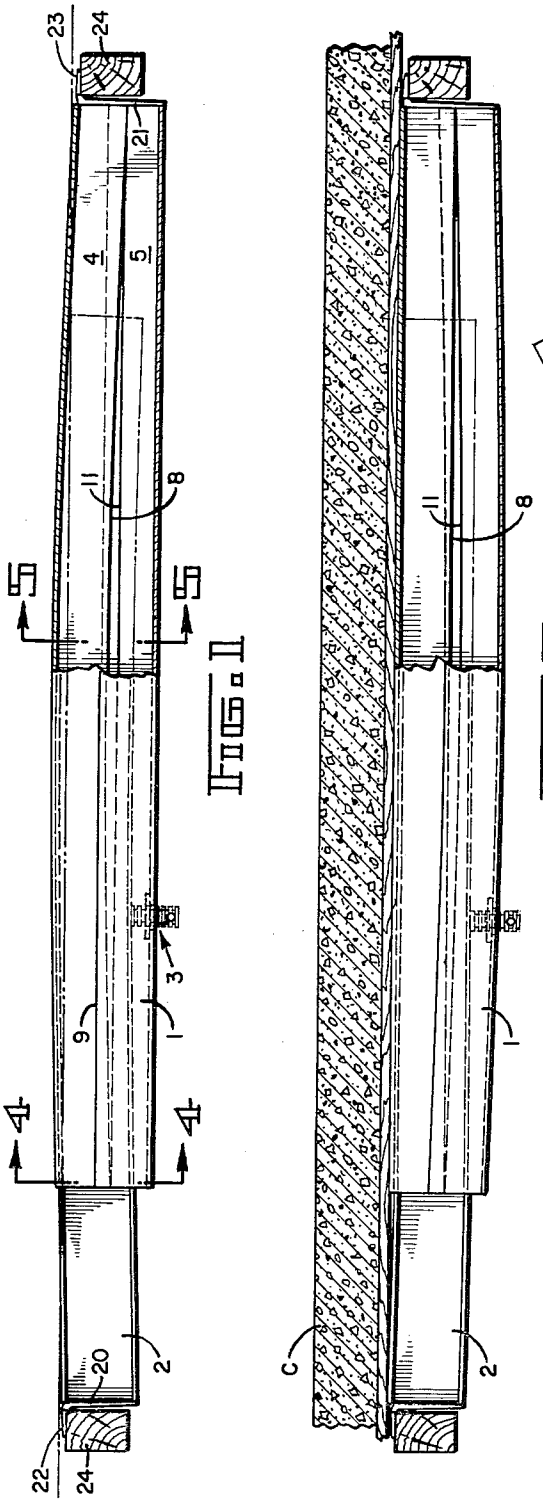


FIG. 1

FIG. 2

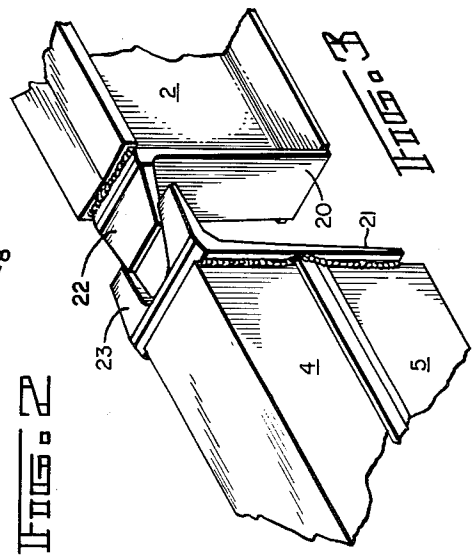


FIG. 3

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FORM SUPPORTING GIRDER FOR USE IN CONCRETE CONSTRUCTION

Filed June 29, 1961 2 Sheets-Sheet 2

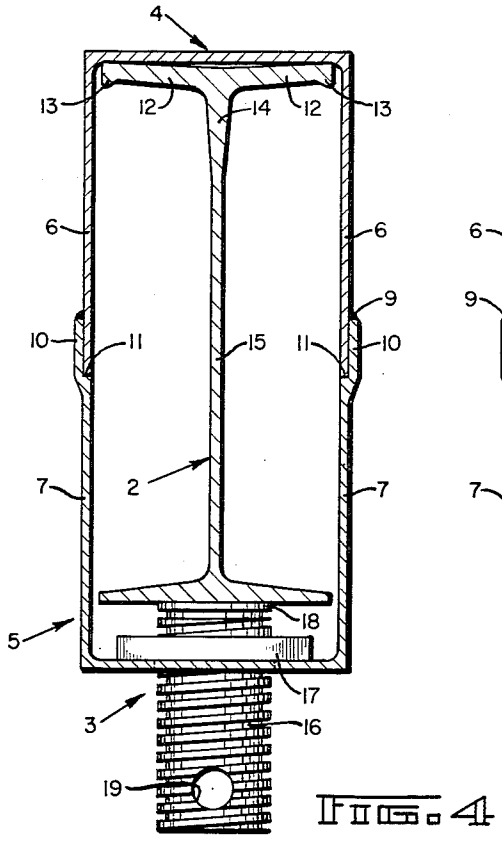


FIG. 4

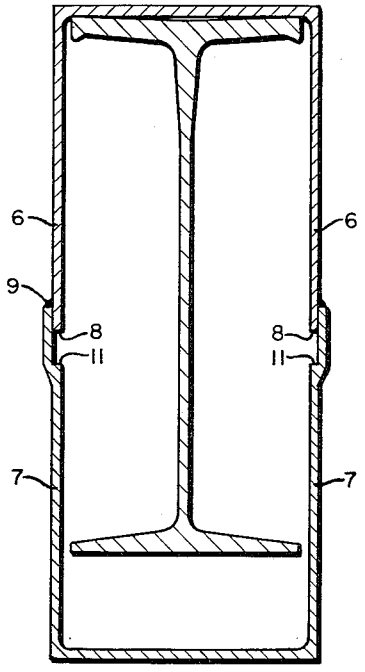


FIG. 5

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United States Patent Office 3,054,486 Patented Sept. 18, 1962

3,054,486

FORM SUPPORTING GIRDER FOR USE IN CONCRETE CONSTRUCTION

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Filed June 29, 1961, Ser. No. 120,733
12 Claims. (Cl. 189—37)

The invention relates to adjustable form supporting girders for concrete construction, and more particularly to improvements in girders of the telescopic type.

In my copending application, Serial No. 17,117, filed March 23, 1960, I have explained some of the difficulties which have been encountered in attempting to adapt telescopic girder design to the production of girders made of a light metal, more especially aluminum. In that application, I disclosed a solution to the problem of how to avoid, or minimize, the effects of the phenomenon known as "flare-out." Other problems have had to be met, including the fundamental one created by the fact that structural aluminum alloys have a modulus of elasticity which is only about one third that of structural steel. Contemplation of this fact suggests that the use of aluminum would seem to impose the need for beams of greater depth and section thickness, with some sacrifice in compactness and weight saving. However, I have discovered a unique combination of structural features which make it possible to obtain, in an aluminum girder of very closely the same depth as a comparable steel girder, deflection values approximately equal to those of the steel girder. Contributing to this accomplishment is the provision of an improved girder section of box form constructed of two extruded channel sections, one cambered and the other straight, the two welded together in a fashion which preserves the camber of the one section while producing a greater depth of the box section where the bending moment is greatest, and while at the same time reinforcing the sides of the section against buckling. Further contributing to such accomplishment is the provision of a unique form of extruded I-beam section having thickened, upwardly canted and edge reinforced, upper flanges, and having a web portion of increased thickness at its upper end to resist torsion applied through the flanges at the axis of intersections of the web and flanges. These and other features and advantages of my invention will now be described more fully with reference to the drawings illustrative of the best mode contemplated by me for carrying out my invention.

FIG. 1 is a side elevational view, partly in vertical section, of a girder constructed in accordance with my invention, showing the girder in place and ready for use. The initial camber of the girder has been somewhat exaggerated to show it more clearly.

FIG. 2 is a similar view, showing the girder deflected under the weight of the poured concrete.

FIG. 3 is a detail perspective view of the meeting ends of two girders, and shows the supporting brackets for both the I-beam and box sections of the girder.

FIG. 4 is an enlarged vertical transverse sectional view taken as indicated at 4—4 in FIG. 1.

FIG. 5 is a similar sectional view taken at 5—5 of FIG. 1.

My adjustable form supporting girder comprises, in its general arrangement, a cambered box-like section 1 and an I-beam section 2 slidable lengthwise within the box-like section for adjustment of the length of the girder, and locking means 3 for holding an outer end surface of the I-beam section pressed against an inner surface of the box-like section. The cambered box-like section is constructed of two channel-shaped members 4 and 5 arranged in opposed relationship with portions

of the flanges 6, 6 of one of such members overlapping portions of the flanges 7, 7 of the other. Member 4 is cambered lengthwise of the girder as can be discerned in FIG. 1, and as will be further understood from a comparison of FIGS. 4 and 5, noting that at the FIG. 5 section the top of the girder is higher than it is at the FIG. 4 section. Also, the lower edges 8 of flanges 6 assume the same arc of camber as does the top surface of member 4. However, member 5 is not cambered at all, but is perfectly straight from end to end.

My concept of making the box section of the girder from two channel sections, one cambered and the other straight, produces a number of highly advantageous new results: (1) the two channel sections are favorably designed for fabrication by the aluminum extrusion process; (2) cambering is simplified by reason of the fact that it is quite easy to camber the upper channel with the use of standard rolling equipment, whereas to camber a box section requires more elaborate special machinery, and also because the lower half of the box section need not be subjected to cambering work; (3) the resulting box section is deeper where the bending moment is greatest—compare FIGS. 4 and 5 and the relative location of the 4—4 and 5—5 section lines in FIG. 1; (4) the overlapping flanges of the cambered and straight channels stiffen the sides of the box section against buckling; (5) because the upper edges of flanges 7 of the lower channel are perfectly straight, no special welding procedure or equipment is required to weld the two channels together, for, notwithstanding the camber of the upper channel 4, a straight line of welding is provided at 9, with the result that the seam welds run parallel with the straight bottom chord, permitting the use of conventional automatic welding equipment; and (6) by reason of the greater depth of the cross-section of the box toward the central portion of the girder, an increased vertical clearance is obtained between the two girder sections toward such central portion, with the result of allowing a greater degree of angling of the one section relative to the other for easier assembly and easier stripping of the girder from the construction after setting of the concrete.

In my preferred girder construction, the overlapping portions of the flanges of the two channel members which form the box section are offset laterally of the girder to permit the main bodies of the flanges 6, 6 and 7, 7 to be coplanar. In the particular construction shown, flanges 7, 7 of the lower channel are offset outwardly, as at 10, 10, and have shoulders 11, 11 which serve as end bearings for the ends 8, 8 of flanges 6, 6 of the upper channel when the two channels are assembled for welding. The offset portions 10, 10 of flanges 7, 7 are of sufficient depth to maintain the overlap of the two channels at the deepest cross-section of the box.

I-beam section 2 of the girder preferably is cambered lengthwise to accommodate it to the camber of the box-like section. Such cambered I-beam section is of uniform depth throughout its length so that the greater depth of the cross-section of the box toward the central portion of the assembled girder will afford increased vertical clearance between the two girder sections toward such central portion, yielding the advantage heretofore described relative to easier stripping of the girder from the forms after setting of the concrete.

The bending moment of the I-beam section is increased and made compatible with the bending moment of the strengthened camber construction of the box section by canting the upper flanges 12 of the I-beam upwardly and outwardly, FIG. 4, making such flanges of increased thickness relative to the lower flanges thereof, and forming them with thickened outer edges 13. Also contributing to the increased bending moment is the increased thickness of the upper portion 14 of the web of the I relative to the main body 15 of the web. The thickness and

taper of web portion 14 have further been found to be of considerable practical value in resisting torsion applied through the canted flanges 12 at the axis of intersection of the planes of such flanges and web 15.

Further contributing to the bending strength and low deflection value of the special I-beam and cambered box sections of my improved girder, is the significant design principle of the locking means which holds the two sections in their proper relation of predetermined camber in any of several positions of length adjustment. A most effective transmission and distribution of stresses between the I and box sections is secured through the use of an externally threaded tube 16 of a diameter which is large enough to directly engage a substantial area of both lower flanges of the I beam. This threaded tube engages a nut plate 17 bearing against the inner bottom of the box section. Threaded tube 16 has a collar 18 at its upper end, providing a limit stop against the nut plate, the tube and nut plate comprising a sub-assembly which is put together with the box section by insertion through the open end thereof and locked in place after assembly of the two sections of the girder by tightening the threaded tube against the outer surface of the lower flanges of the I-beam section. Tightening is easily performed by means of a wrench or suitable bar inserted in opening 19 of the tube. The tube and nut plate are desirably made of galvanized steel.

The girder sections are provided with suitable end supporting brackets 20, 21, FIG. 3, whose flanges 22, 23 will rest on top of beams or ledgers 24 in accustomed fashion. Normally the girders are placed to support plywood or other suitable forms 25 to carry the poured concrete C. A comparison of FIGS. 1 and 2 will show how the camber of the free girder (FIG. 1, camber exaggerated) subsides under the load imposed by the concrete (FIG. 2). Notice that upper channel section 4 is cambered, lower channel section straight in FIG. 1, whereas this condition is exactly reversed in FIG. 2 where the upper channel has straightened out, imposing a downward curvature upon the lower channel. Notice also line 8, curved in FIG. 1, straight in FIG. 2; and line 11, straight in FIG. 1, curved in FIG. 2.

While my improved girder and girder sections have been developed primarily to meet the special problems encountered in the production of girders made of aluminum alloys possessing a modulus of elasticity much lower than that of steel, I recognize that some or all of the structural features I have disclosed can be of value for use in girders of other materials, not excepting steel, and including, for example, fiberglass or other structural plastic resin products.

The terms and expressions which I have employed are used in a descriptive and not a limiting sense, and I have no intention of excluding equivalents of the invention described and claimed.

I claim:

1. An adjustable cambered form-supporting girder for concrete construction comprising a cambered box-like section and an I-beam section slidable lengthwise within the cambered box-like section for adjustment of the length of the girder, locking means for holding an outer end surface of the I-beam section pressed against an inner surface of the cambered box-like section, said cambered box-like section being constructed of two channel-shaped members arranged in opposed relationship with portions of the flanges of one of the channel-shaped members overlapping portions of the flanges of the other, the one channel-shaped member being cambered lengthwise and the other being straight, and the overlapping portions of the flanges of the two being secured together to provide a box-like section having a cambered upper surface and a straight lower surface, the cross-section of the box being of greater depth toward the central portion of the assembled girder than at the free end of the box-like section.

2. An adjustable cambered form-supporting girder according to claim 1, in which the overlapping portions of the flanges of said other channel-shaped member are offset laterally of the girder to permit the main bodies of said flanges to be coplanar with the flanges of the first-named channel-shaped member, such offset portions being of sufficient depth to maintain the overlap of the two channel-shaped members at the deepest cross-section of the box.

3. An adjustable cambered form-supporting girder according to claim 1, in which said I-beam section is cambered lengthwise to accommodate it to the camber of the box-like section, the I-beam section being of uniform depth throughout its length whereby the greater depth of the cross-section of the box toward the central portion of the assembled girder affords increased vertical clearance between the two girder sections toward such central portion, thus to allow a greater degree of angling of the one section relative to the other for easier stripping of the girder from the construction after setting of the concrete.

4. An adjustable cambered form-supporting girder according to claim 1, in which the bending moment of the I-beam section is made compatible with the bending moment of the strengthened camber construction of the box-like section by canting the upper flanges of the I-beam upwardly and outwardly.

5. An adjustable cambered form-supporting girder according to claim 1, in which the bending moment of the I-beam section is made compatible with the bending moment of the strengthened camber construction of the box-like section by making the upper flanges of the I-beam of increased thickness relative to the lower flanges thereof.

6. An adjustable cambered form-supporting girder according to claim 1, in which the bending moment of the I-beam section is made compatible with the bending moment of the strengthened camber construction of the box-like section by canting the upper flanges of the I-beam upwardly and outwardly and making such flanges of increased thickness relative to the lower flanges of the I-beam.

7. An adjustable cambered form-supporting girder according to claim 1, in which the overlapping flanges of the cambered and straight channel-shaped members of the box-like section of the girder are secured together by a straight line weld following the straight edges of the flanges of the straight member at a progressively varying distance from the curved edges of the flanges of the cambered member .

8. A box-like section for an adjustable cambered form-supporting girder for concrete construction, said box-like section being constructed of two channel-shaped members arranged in opposed relationship with portions of the flanges of one of the channel-shaped members overlapping portions of the flanges of the other, the one channel-shaped member being cambered lengthwise and the other being straight, and the overlapping portions of the flanges of the two-being secured together to provide a box-like section having a cambered upper surface and a straight lower surface, the cross-section of the box being of greater depth toward the central portion of the girder than at the free end of the box-like section.

9. A box-like section for an adjustable cambered form-supporting girder according to claim 8, in which the overlapping portions of the flanges of said other channel-shaped member are offset laterally of the girder to permit the main bodies of said flanges to be coplanar with the flanges of the first-named channel-shaped member, such offset portions being of sufficient depth to maintain the overlap of the two channel-shaped members at the deepest cross-section of the box.

10. A box-like section for an adjustable cambered form-supporting girder according to claim 8, in which the overlapping flanges of the cambered and straight channel-shaped members are secured together by a straight line weld following the straight edges of the flanges of the straight member at a progressively varying distance from the curved edges of the flanges of the cambered member.

11. An adjustable cambered form-supporting girder according to claim 1, in which said locking means comprises an externally threaded tube engaging a nut plate bearing against the inner bottom of the box-like section of the girder, said threaded tube directly engaging a substantial area of both lower flanges of the I-beam section of the girder.

12. An adjustable cambered form-supporting girder according to claim 1, in which said locking means comprises an externally threaded tube engaging a nut plate bearing against the inner bottom of the box-like section of the girder, said threaded tube directly engaging a substantial area of both lower flanges of the I-beam section of the girder and having a collar at its upper end providing a limit stop against the nut plate, the tube and nut plate comprising a sub-assembly which is assembled with said box-like section by insertion through the open end

thereof and locked in place after assembly of the two sections of the girder by tightening the threaded tube against the outer surface of the lower flanges of the I-beam section.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,054,486 September 18, 1962

Henry A. de la Rambelje

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 55, for "two-being" read -- two being --; column 6, line 11, for "2,737,117" read -- 2,734,117 --.

Signed and sealed this 5th day of March 1963.

(SEAL)

Attest:

ESTON G. JOHNSON

Attesting Officer

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Commissioner of Patents