

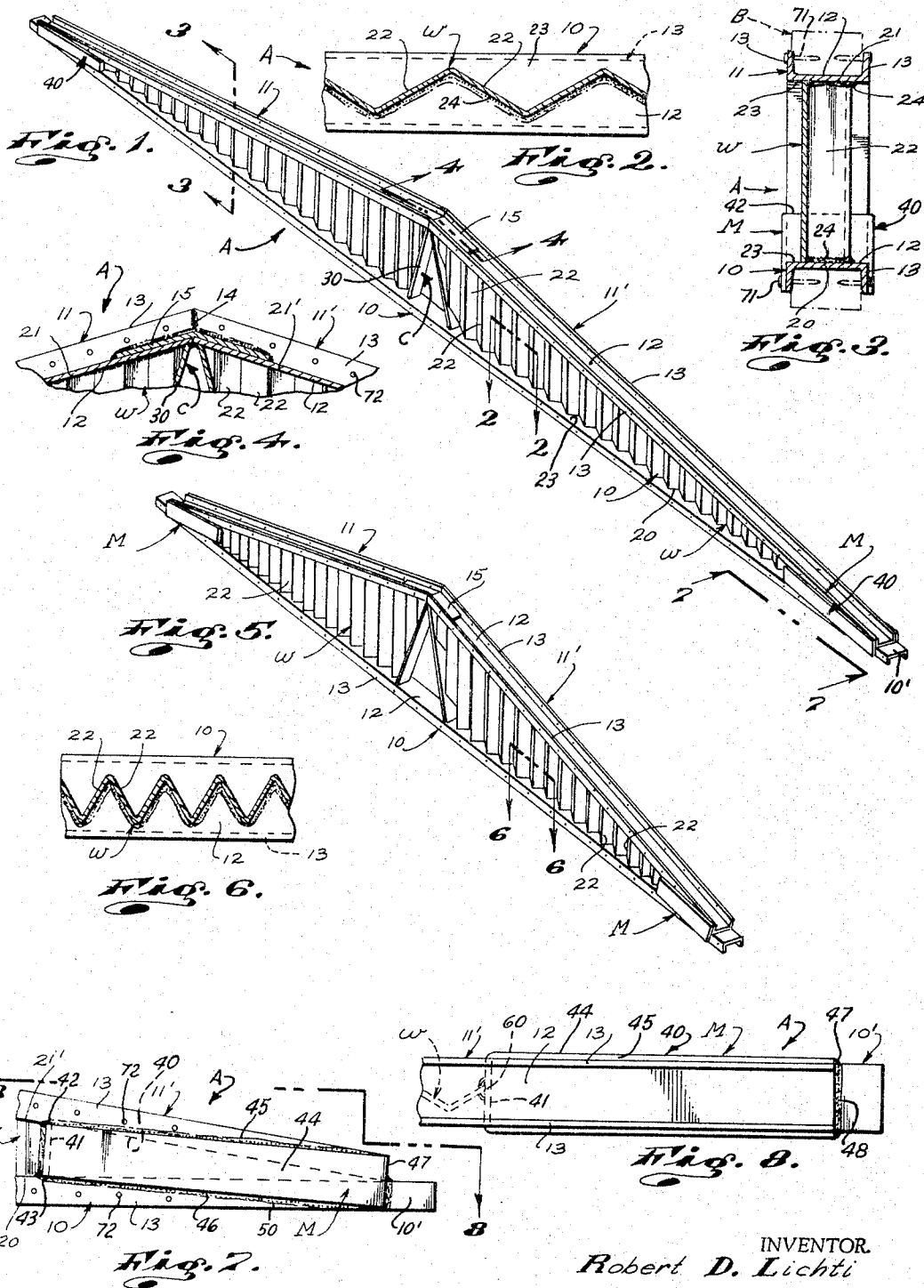
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R. D. LICHTI

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TAPERED GIRDER CONSTRUCTION

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INVENTOR
Robert D. Lichti

BY
George P. Matwell

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TAPERED GIRDER CONSTRUCTION

Robert D. Licht, Long Beach, Calif. (% Lihap Industries,
P.O. Box 510, Whittier, Calif. 90608)

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This invention relates to a fabricated steel structure and is more particularly concerned with a novel single web, taper girder construction.

In the art of beams and girders, it is common practice to fabricate girders with varying cross-sections so that they have substantially uniform strength throughout their length. This is particularly true in the case of girders which are to be uniformly loaded, such as girders in buildings which are supported at their opposite ends, bridge open expanses and serve to support roofing or flooring structures and the like.

The primary purposes of tapered girders, such as referred to above are: First, to reduce the amount of material used and thereby reduce the cost of the girders; second, to provide a lighter weight construction; third, to conserve space; and fourth, to provide a desired functional configuration, as where the girders are used to support a roof structure which it is desired to pitch or incline for drainage purposes.

In establishing tapered girders standard practice includes the establishment of the cord members or flanges of such girders from flat plate stock of sufficient cross-sectional area to withstand the tensile and compressive stresses to be encountered, and of sufficient lateral extent to provide sufficient stiffness and rigidity to withstand the lateral and torsional forces to be encountered.

Another standard practice is to establish the webs of flat plate stock, which stock is sufficiently heavy to withstand the compressive, tensile and resulting shear stresses exerted through their flat planes and which tend to ripple or buckle the webs.

At present, there exists a great demand for a lighter weight tapered girder than can be established in accordance with standard girder constructions, and a girder of the character referred to having narrower, more compact flanges, and which is nonetheless stiffer and more resistant to lateral and/or torsional deflection and distortion.

In welded, single web, tapered girders, forces which tend to buckle the webs are transmitted through the lines of joinder between the webs and the flanges.

Accordingly, webs having sufficient thickness to resist buckling, must be employed and a line of weld must be established along both sides of the edges of the web where they join their related flanges, so as to gusset both corners established thereby. This practice materially increases the cost of fabrication.

Where the turning moments of force between the flanges and web plates is considerable, it is common practice to provide separate gusseting members.

Another factor in the design of a girder is the ability of the girder to withstand impact. As a general rule, a girder is made to withstand normal or anticipated impacts. The establishment of destructive or detrimental harmonics and whipping of the conventional flat web-flat flange girders as a result of impact, is not uncommon and is normally corrected by supplemental bracing and the like to increase stiffness and to thereby dampen or buffer harmonic or whipping action.

In ordinary tapered girder constructions the compressive and tensile stresses are resolved at the points of convergence of the ends of the flanges. Accordingly, the ends of such girders are ordinarily beefed up, laminated and in effect, boxed-in, to provide the necessary stock and strength to withstand the forces resolved at the ends

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of the girders. It is not uncommon when reinforcing the ends of said girders to employ rivets and other similar fastening means rather than welding, since there is frequently insufficient properly disposed surfaces and stock of material to facilitate adequate weld.

An object of the present invention is to provide an improved light weight, single web plate, tapered girder construction.

Another object of my invention is to provide a girder construction of the character referred to wherein the web plate is established of sheet stock corrugated throughout its longitudinal extent along lines normal to one of the flanges of the girder, whereby the web, when the edges are fixed to the flanges, provides an effective depth to lateral forces, equivalent to a flat plate web many times wider, or having a lateral depth many times greater than the stock from which the corrugated web is established; and a web which is considerably lighter than a flat web of equivalent lateral stiffness.

A further object of my invention is to provide a structure of the character referred to wherein the edges of the corrugated web are welded to adjacent surfaces of the girder flanges to extend longitudinally and diagonally therealong on a zig-zag pattern, whereby the web reinforces and stiffens the flanges, with the result that the flanges can be established of considerably thinner stock and made considerably narrower than is possible in girder constructions having flat webs and with the result that a single line of weld along one of the corners established by each flange and the web is sufficient.

Still further, it is an object of this invention to provide a girder construction of the character referred to wherein the zig-zag edges of the web provide materially greater and more effective, lateral bearing support for the flanges than is provided by a flat web, with the result that a single line of weld along one of the corners established by each flange and the web is sufficient.

It is another object of my invention to provide a girder construction of the character referred to wherein the flanges are established of outwardly opening channel sections and cooperatively receive wooden blocks or stringers, which blocks or stringers reinforce and support the channel shaped flanges in fixed configuration and against distortion and which also serve as a foundation through or on which structure related to the girder can be fixed by means of suitable wood fasteners.

A further object of this invention is to provide the side or leg portions of the channels establishing the girder flanges with longitudinally spaced openings to receive wood fasteners for securing the blocks or stringers in fixed position in the flanges.

A further object of the present invention is to provide a girder construction of the character referred to wherein the corrugated web stiffens the construction and effectively buffers or dampens harmonics or whipping action that might be established by impact upon the girder.

Still another object of my invention is to provide a novel, improved, extremely simple and highly effective welded connecting means for the converging ends of the flanges of a tapered girder of the general character referred to.

Finally, it is an object of my invention to provide a corrugated web of the character referred to wherein the corrugations establish flat, angularly related diagonally extending panels throughout the longitudinal extent of the girder and the edges of said web are straight, longitudinally of the web; whereby, said web can be accorded or extended and compacted longitudinally to vary its longitudinal and/or lateral extent as circumstances require.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of my

invention, throughout which description reference is made to the accompanying drawing, in which:

FIGURE 1 is a perspective view of a girder embodying the present invention;

FIGURE 2 is an enlarged detailed sectional view taken as indicated by line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged detailed sectional view taken as indicated by line 3—3 on FIGURE 1;

FIGURE 4 is an enlarged detailed sectional view taken as indicated by line 4—4 on FIGURE 1;

FIGURE 5 is a view similar to FIGURE 1, showing a girder of equal height; shorter length and having a less acute taper than the girder shown in FIGURE 1, and having a corrugated member established by a web identical to the web employed to establish the web in the girder shown in FIGURE 1;

FIGURE 6 is an enlarged detailed sectional view taken as indicated by line 6—6 on FIGURE 5;

FIGURE 7 is an enlarged detailed elevational view taken as indicated by line 7—7 on FIGURE 1; and

FIGURE 8 is an elevational view taken as indicated by line 8—8 on FIGURE 7.

For purpose of illustration, I have shown a fabricated tapered, steel girder A, embodying the present invention, which girder is particularly adapted for use in a building for supporting a roof structure or the like. It is to be understood, however, that tapered girders of other configurations and for other general or special use and application can be established in accordance with my invention without departing from the spirit thereof.

The girder A is shown as including a straight elongate horizontally disposed lower flange 10, and a sectional upper flange having left and right hand, longitudinally inwardly and upwardly converging sections 11 and 11'.

The flanges 10 and 11-11' are established from channel stock having flat horizontally disposed base portions 12 and flat, vertically disposed, laterally spaced and longitudinally extending side or leg portions 13, which leg portions can project outwardly or inwardly as circumstances require. In the preferred carrying out of the invention the leg portions of the flanges extend outwardly about the periphery of the girder and are adapted to receive suitable blocking B, as illustrated in phantom lines in FIG. 3 and as will hereinafter be described.

The ends of the lower flange 10 and the related outer ends of the sections 11 and 11' converge and are secured together at the heels of the girder by a novel connecting means M, as will hereinafter be described.

The opposing ends of the sections 11 and 11' of the top flange are mitered to establish flat butted engagement with each other, and are suitably welded together as indicated at 14. Since this butt joint in the construction is normally subjected to compressive stresses, the weld 14 is normally adequate, however, in the preferred carrying out of the invention, and as illustrated in the drawings, I provide an elongate tie plate 15, fixed to the adjacent end portions of the flange sections by welding, and bridging said butt joint. The tie plate 15 serves to receive any lateral stresses and shear stresses imparted onto and through that portion of the upper flange and which might otherwise break the weld 14.

The structure thus far described establishes the basic girder form, that is, the flanges 10, 11 and 11' arranged and secured together in the manner set forth above, establish a load supporting framework or structure. The girder thus formed is of maximum vertical extent or height and consequently strongest, at its center, and tapers longitudinally outwardly towards each end so as to become progressively less strong as it approaches its supporting ends. In practice, the taper and progressive diminution in height and resulting strength is determined by the turning moments to be encountered throughout the longitudinal extent of the girder, when loaded.

In addition to the foregoing, the girder A is provided with a central web W, arranged within the confines of

the flanges, on a vertical plane, to occupy the bay established by the flanges.

The web W, in addition to other functions and purposes, serves to brace, reinforce and support the flanges throughout their longitudinal extent and to prevent deflection of the flanges intermediate their ends as a result of vertical loading.

The web further serves to reinforce and support the flanges laterally against lateral forces and against laterally spaced vertical forces which are resolved in lateral turning moments and which tend to twist or turn the flanges relative to the adjacent edges of the flanges.

The web W is an elongate vertically disposed sheet metal part or member of generally triangular or pentagonal shape having the straight horizontally disposed bottom edge 20 and longitudinally inwardly and upwardly inclined upper edges 21 and 21'. The web is corrugated throughout its longitudinal extent, the corrugations extending vertically and transverse the longitudinal axis of the girder. The corrugations are angular, establishing integrally joined, flat panels 22 extending diagonally of the longitudinal axis of the girder in an alternating or zig-zag pattern and intersecting the central longitudinal vertical plane of the girder.

The zig-zag edges 21 and 21' of the web W establish flat bearing engagement on the inner surfaces 23 of the base portions 12 of the flange sections 11 and 11' related thereto and are fixed to said flange sections by a continuous line of weld 24 at the corner established by one side of the web and the surfaces 23 of the said flange sections (see FIGURE 3).

The lower zig-zag edge 20 of the web establishes flat bearing engagement on the inner surface 23 of the base portion 12 of the lower flange and is fixed thereto by a continuous weld 24 at the corner established by one side of the web and the surface 23 of the flange 10.

The welded connection between the several flanges and their related edges of the web maintain the edges and the several flat panels 22 of the web in fixed position and thereby prevents accordioning, that is, longitudinal shifting or other similar displacement of the web. Each panel 22 is, in effect, a strut between the flanges related thereto. Each panel being integrally joined with each adjacent panel and being on a plane at an angle to its adjacent panels also serve to brace and support the adjacent panels and prevent said panels from distorting.

As a result of the above, it will be apparent that when the construction is made up or fabricated, each of the several panels is supported about its entire perimeter by the flanges and adjacent panels and in turn serve to support said adjacent flanges and panels, to the end that an extremely rigid and stable integrated construction is provided.

It is to be noted that the upper and lower edges of each panel of the web W, which extends diagonally across its related surfaces 23 of the flanges, affords considerable lateral bearing support for the flanges and increases the effective lateral depth of the structure to resist lateral deflection and turning moments. Accordingly, the flanges can be materially less in lateral extent than would be possible if the web were flat, or it struts were used in place of the corrugated web.

By providing a corrugated web as set forth above, a self-supporting web structure is provided, which web structure can be established of light-weight sheet material which would not be self supporting if flat and disposed in a similar plane.

The corrugated web provided by the present invention is as strong and rigid, when positioned in the integrated girder, as a flat web many times as thick and many times heavier.

In practice, if desired, the web W can, as illustrated, be relieved or cut away to establish an access bay or opening C.

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In the case illustrated, the bay or access opening C is arranged at the center of the girder and is defined by a pair of elongate upwardly convergent plate like struts 30 to which the adjacent edges of the web, that is, the edges defined by the removal of web stock to establish the opening, are fixed by welding.

The struts 30, in addition to framing the opening C also serve as stress members, in the same manner as struts in a conventional, strut-type, open bay girder, and are of such cross-section and such angular disposition as to compensate for the loss of strength imparted into the structure by the removal of web stock in establishing the opening.

While in practice, a bay or opening in the girder can be established in any desired configuration and arranged at any location longitudinally of the girder, the construction illustrated and described is most satisfactory, as it is extremely easy to calculate and can be established without adversely affecting the strength of the girder, and is extremely easy and economical to establish.

The connecting means M securing the outer ends of the flanges 11 and 11' with their related ends of the flange 10 includes an elongate horizontally disposed U-shaped cleat 40 established of strapped steel. The cleat 40 has a flat generally vertically disposed inner portion 41 with straight upper and lower edges 42 and 43, and elongate flat, vertically disposed, longitudinally extending legs or side plates 44 with straight upper and lower edges 45 and 46 and terminating at vertical end edges 47. The vertical extent of the strap stock from which the cleats are established is equal or preferably slightly less than the combined vertical extent or height of the upper or lower flanges.

The base portions 12 of the related flanges are initially welded together across their converging ends, as indicated at 48 in FIGURES 7 and 8 of the drawings.

The cleat 40 is next arranged so that the inner portion 41 thereof extends transversely between the upper and lower flanges with which it is related and so that the plates 44 establish flat bearing engagement on the adjacent leg portions of the flanges. The cleat is then urged longitudinally outwardly so that the upper and lower edges of the inner portion establish tight wedging engagement with the inner surfaces 23 of the adjacent flanges.

When thus arranged, a line of weld 50 is established between the cleat and the flanges, which weld extends about the entire perimeter of the cleat.

The weld occurring along the upper and lower edges of the plate portions of the cleat extend diagonally of the adjacent leg portions of the flanges at a very slight or shallow angle, with the result that a considerable amount of highly effectively disposed weld is provided between flanges and the plate portions of the cleat, and through which the tensile and compressive stresses in the flanges are transmitted, to be resolved in the plates.

The cleat and flanges are assembled and affixed together so as to establish a longitudinally outwardly convergent closed box section which is extremely rigid and strong. Further, as the flanges converge longitudinally outwardly from the inner portion of the cleat and the effective height of the girder and its resulting strength is diminished, the rearwardly extending plate portion of the cleat progressively increase in lapped engagement with the leg portions of the flanges and cooperate therewith to establish an extremely strong laminated construction.

In practice, the means M is made up before the web W is arranged in the construction. The ends of the web are cut so that its vertical end edges 60 are equal in vertical extent with the vertical extent of the cleat. These end edges establish butted engagement on the inner portions of the cleats when the web is arranged within the flanges and are fixed thereto by welding, as clearly illustrated in the drawings.

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In the preferred carrying out of the invention the ends of the horizontal, lower flanges 10 are provided with extensions 10' at each end, which extensions provide suitable mounting pads to engage and rest on piers or other suitable supporting structures with which the girder is to be related.

The outwardly opening channel shaped flanges 10, 11 and 11' are provided with suitable wooden mounting blocks or stringers B, indicated in phantom lines on FIGURE 3 of the drawings, which blocks or stringers are arranged within the confines of the base and leg portions of the flanges and are fixed therein by suitable wood fasteners 71 engaged through longitudinally spaced fastener receiving openings 72 provided in the leg portions of the flanges.

The blocks B serve to reinforce and support the channel shaped flanges in fixed configuration and also provide an anchoring structure or means on or incorporated in the girder A to facilitate the securing and/or fixing of other wooden structure and the like to the girder.

In FIGURES 5 and 6 of the drawings, I have illustrated a girder construction which is structurally the same as the girder construction illustrated in FIGURE 1 of the drawings, the only difference being that the second girder is shorter than the girder shown in FIGURE 1, is tapered at the less acute angle and the web is compacted longitudinally so that the effective width of the web is increased and the adjacent panels thereof are arranged at more acute angles.

In this modified girder, the web is established from an identical piece of web stock or blank as was used in establishing the web in the first form of the invention.

In light of the above, it will be apparent that provided with a stock of several different sizes and shapes of corrugated web blanks, one can establish girders of many different lengths, by simply selecting the proper or desired size of web blank and simply accordioning it, that is, drawing it or compressing it longitudinally, to the desired length.

The ability to vary the length of the web in the manner set forth above eliminates the necessity of having to lay out and especially cut each web, when a web of slightly different length is required, as in the case of conventional flat web girder constructions.

It will be apparent that with the corrugated webs that I provide, fitting of the webs in and with the flanges is extremely simple and effective, as it is only necessary to compact and accordion web blanks longitudinally between the outwardly convergent flanges to which the blanks are related, to assure uniform, uninterrupted bearing engagement between the webs and the flanges.

In the case of flat web flanges, the flanges must be carefully and exactly cut to assure a proper fit and little or no margin of error can be afforded.

Having described only a typical preferred form and application of my invention, I do not wish to be limited to the specific details herein set forth, but wish to reserve to myself any modifications and variations that may appear to those skilled in the art, and which fall within the scope of the following claims.

Having described my invention, I claim:

1. An elongate, tapered girder including a substantially triangular vertically disposed central web, and three straight elongate flange sections extending about the perimeter of the web, said web being corrugated throughout its longitudinal extent to establish a plurality of integrally joined, flat panels extending alternately laterally and diagonally through the central vertical plane of the girder, said flange sections being fixed to the adjacent edges of the web by welding.

2. An elongate vertically disposed horizontally extending tapered girder including, an elongate, substantially triangular vertically disposed central web, and three straight elongate flange sections extending about the perimeter of the web, said web being corrugated

throughout its longitudinal extent to establish a plurality of integrally connected flat panels extending alternately diagonally through the central vertical plane of the girder and in a direction normal to one of said flange sections, and to define zig-zag flange engaging edges on the web, the flange engaging edges of the web extending diagonally across the adjacent surfaces of their related flange sections and fixed thereto by a continuous line of weld.

3. An elongate, tapered girder including a substantially triangular vertically disposed central web, and three straight elongate flange sections extending about the perimeter of the web, said web being corrugated throughout its longitudinal extent to establish a plurality of flat, integrally joined panels extending alternately diagonally through the central vertical plane of the girder, said flange sections being fixed to the adjacent edges of the web by welding, said flange sections having flat longitudinal base portions normal to the web and outwardly projecting longitudinal leg portions and defining work receiving channels.

4. An elongate vertically disposed horizontally extending tapered girder including, an elongate, substantially triangular vertically disposed central web, and three straight elongate flange sections extending about the perimeter of the web, said web being corrugated throughout its longitudinal extent to establish a plurality of integrally connected flat panels extending alternately diagonally through the central vertical plane of the girder and in a direction normal to one of said flange sections, and to define straight zig-zag flange engaging edges on the web, the flange engaging edges of the web extending diagonally across the adjacent surfaces of their related flange sections and fixed thereto by a continuous line of weld, said flange sections having flat longitudinal base portions normal to the plane of the web and having outwardly projecting longitudinal leg portions and defining work receiving channels.

5. An elongate, tapered girder including a substantially triangular vertically disposed central web, and three straight elongate flange sections extending about the perimeter of the web, said web being corrugated throughout its longitudinal extent to establish a plurality of flat panels extending alternately diagonally through the central vertical plane of the girder, said flange sections being fixed to the adjacent edges of the web by welding, said flange sections having flat longitudinal base portions normal to the vertical plane of the web, outwardly projecting longitudinal leg portions, and wooden, work-engaging stringers arranged in the confines of the base and leg portions to project outwardly therefrom.

6. An elongate vertically disposed horizontally extending tapered girder including, an elongate, substantially triangular vertically disposed central web, and three straight elongate flange sections extending about the perimeter of the web, said web being corrugated throughout its longitudinal extent to establish a plurality of integrally connected flat panels extending alternately diagonally through the central vertical plane of the girder and in a direction normal to one of said flange sections, and to define zig-zag flange engaging edges on the web, the flange engaging edges of the web extending diagonally across the adjacent surfaces of their related flange sections and fixed thereto by a continuous line of weld, said flange sections having flat longitudinal base portions normal to the central vertical plane of the web, outwardly projecting longitudinal leg portions, and wooden, work-engaging, blocks arranged in the confines of the base and leg portions to project outwardly therefrom.

7. An elongate, tapered girder including a substantially triangular vertically disposed central web, and three straight elongate flange sections extending about the perimeter of the web, said web being corrugated throughout its longitudinal extent to establish a plurality of flat panels extending alternately diagonally through the central vertical plane of the girder, said flange sections being

fixed to the adjacent edges of the web by welding, said flange sections having flat longitudinal base portions normal to the vertical plane of the web, outwardly projecting longitudinal leg portions, and wooden, work-engaging stringers arranged in the confines of the base and leg portions to project outwardly therefrom, said leg portions of the flange sections having a plurality of longitudinally spaced fastener receiving openings and fasteners engaged through said openings and into the stringers.

8. An elongate vertically disposed horizontally extending tapered girder including, an elongate, substantially triangular vertically disposed central web, and three straight elongate flange sections extending about the perimeter of the web, said web being corrugated throughout its longitudinal extent to establish a plurality of integrally connected flat panels extending alternately diagonally through the central vertical plane of the girder and in a direction normal to one of said flange sections, and to define zig-zag flange engaging edges on the web, the flange engaging edges of the web extending diagonally across the adjacent surfaces of their related flange sections and fixed thereto by a continuous line of weld, said flange sections having flat longitudinal base portions normal to the central vertical plane of the web, outwardly projecting longitudinal leg portions, and wooden, work-engaging, blocks arranged in the confines of the base and leg portions to project outwardly therefrom, said leg portions of the flange sections having a plurality of longitudinally spaced fastener receiving openings and fasteners engaged through said openings and into the blocks.

9. An elongate, tapered girder including an elongate pentagonal vertically disposed central web with straight generally vertical end edges, and three straight elongate flange sections extending about the perimeter of the web, said web being corrugated throughout its longitudinal extent to establish a plurality of panels extending alternately diagonally through the central vertical plane of the girder, said flange sections being fixed to the adjacent edges of the web by welding; and means at the ends of the web and adjacent converging ends of the flange sections to connect the flange sections and web together including, an elongate U-shaped cleat having a generally vertically disposed transversely extending inner portion arranged to occur adjacent the end edge and between the adjacent end portions of the flange sections and longitudinally outwardly projecting plates at the ends of the inner portion to occur adjacent the opposite sides of the flange sections and fixed to the web and flange sections by welding.

10. An elongate vertically disposed horizontally extending tapered girder including, an elongate, pentagonal vertically disposed central web with a straight, horizontal bottom edge, a pair of upwardly inclined top edges and generally vertical end edges, and three straight elongate flange sections extending longitudinally of the top and bottom edges and about the perimeter of the web, said web being corrugated throughout its longitudinal extent to establish a plurality of integrally connected flat panels extending alternately diagonally through the central vertical plane of the girder and in a direction normal to said flange adjacent the bottom edge, and to define zig-zag flange engaging edges on the web, the flange engaging edges of the web extending diagonally across the adjacent surfaces of their related flange sections and fixed thereto by continuous lines of weld; and means at the adjacent converging ends of the flange sections at the ends of the girder to connect the flange sections and webs together including, an elongate U-shaped cleat having a generally vertically disposed transversely extending inner portion arranged to occur adjacent and between the end edge of the web and the adjacent ends of the flange sections and longitudinally outwardly projecting plates at the ends of the inner portion to occur adjacent the opposite sides of the flange sections and a continuous line of weld about the lines of contact between the web flanges and the cleat.

11. An elongate, tapered girder including an elongate pentagonal vertically disposed central web with inclined upwardly convergent top edges, and three straight elongate flange sections extending about the perimeter of the web, said web being corrugated throughout its longitudinal extent to establish a plurality of panels extending alternately diagonally through the central vertical plane of the girder, said flange sections being fixed to the top and bottom edges of the web by welding, said flange sections having flat longitudinal base portions normal to the web and outwardly projecting longitudinal leg portions; and means at the adjacent converging ends of the flange sections at the edge of the girder to connect the web and flange sections together including, an elongate U-shaped cleat having a generally vertically disposed transversely extending inner portion arranged to occur between and to engage the adjacent end edge of the web and the base portions of the flange sections, and elongate vertical plate portions at the ends of the inner portion to project longitudinally outwardly therefrom and to occur adjacent the leg portions of the flange sections and a continuous line of weld about the perimeter of the cleat and between the cleat and the related flange sections and between the cleat and the end edge of the web.

12. An elongate vertically disposed horizontally extending tapered girder including, an elongate, pentagonal, vertically disposed central web with a horizontal bottom edge, a pair of upwardly inclined and converging top edges and generally vertical end edges, and three straight elongate flange sections extending longitudinally of the top and bottom edges and about the perimeter of the web, said web being corrugated throughout its longitudinal extent to establish a plurality of integrally connected flat vertical panels extending alternately diagonally through the central vertical plane of the girder and to define zig-zag flange engaging edges at the top and bottom edges of the web, the flange engaging edges of the web extending diagonally across the adjacent flange surfaces of their related flange sections and fixed thereto by a continuous line of weld,

said flange sections having flat longitudinal base portions normal to the central vertical plane of the web, outwardly projecting longitudinal leg portions, work-engaging wood blocks arranged in the confines of the base and leg portions to project outwardly therefrom, said leg portions of the flange sections having a plurality of longitudinally spaced fastener receiving openings and fasteners engaged through said openings and into the blocks; and means at the adjacent converging ends of the flange sections at each end of the girder to connect the flange and the web together including, an elongate U-shaped cleat having a generally vertically disposed transversely extending inner portion arranged to occur between and to engage the adjacent end edge of the web and base portions of the flange sections at each end of the girder, an elongate vertical plates at the ends of the inner portion to project longitudinally outwardly therefrom and to occur adjacent the leg portions of the adjacent flange sections and a continuous line of weld about the perimeter of the cleat and between the cleat and the related flange sections and a line of weld between the cleat and the adjacent end edge of the web.

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HARRISON R. MOSELEY, *Examiner*.

D. L. TAYLOR, *Assistant Examiner*.