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EXTENSIBLE GIRDER CONSTRUCTION
AND CLAMPING MEANS THEREFOR

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2 Sheets-Sheet 1

Fig. 1

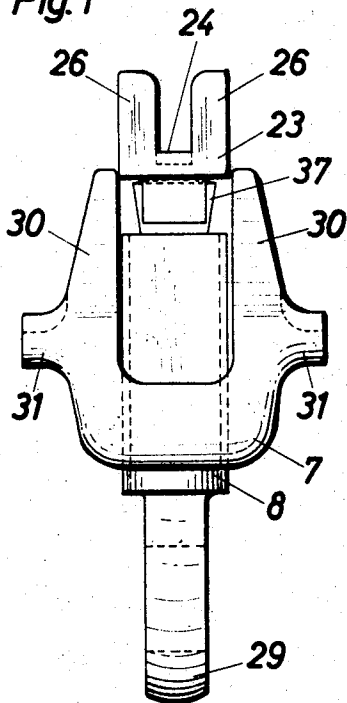


Fig. 2

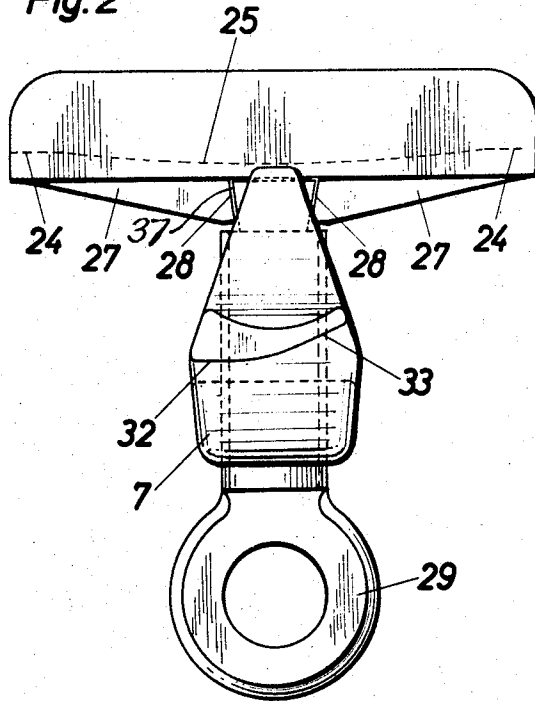


Fig. 4

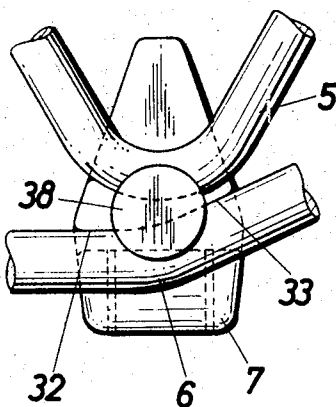
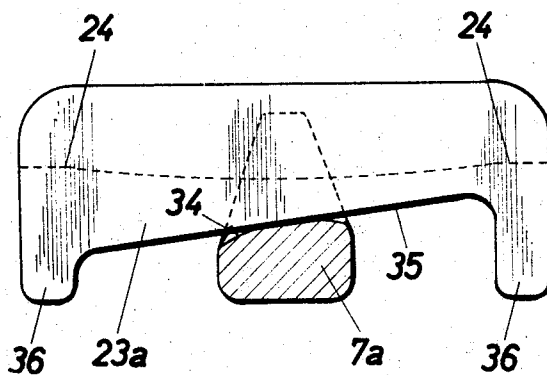


Fig. 3

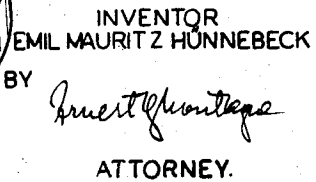


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EXTENSIBLE GIRDER CONSTRUCTION AND CLAMPING MEANS THEREFOR

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The present invention relates to clamping means for temporary extensible girder units.

The employment of extensible girder units has increased more and more each year in view of the fact that such girder units can easily be adapted to various spans and can be employed over and over again. The basis for the employment of extensible girder units consists in their economy which in its turn depends primarily on the price, i.e. on the cost of production of the girder units. Therefore, it is imperative to keep the weight per unit of load carrying capacity of the girder unit as low as possible. If, to this end, the inner girder is designed as a lattice girder or as a plate girder with relatively thin plate web, the difficulty of absorbing the clamping pressure on the inner girder increases. This pressure multiplied by the safety factor is to be absorbed by the diagonal braces of the lattice girder or the web of the plate girder. These facts have heretofore limited the possible reduction in weight of the girder unit.

It is, therefore, one object of the present invention to provide a clamping means which will overcome the above mentioned drawbacks.

It is another object of the present invention to provide a clamping means for extensible girder units which will make it possible further to reduce the weight of such girder units.

It is still another object of the present invention to provide in an extensible girder unit assembly having an outer girder with lower chords and an inner girder with a lower chord, a clamping device comprising a relatively long and narrow pressure member provided with two supporting surface sections spaced from each other in the longitudinal direction of said pressure member and an intermediate surface section between the supporting surface sections, said supporting surface sections elevated relative to said intermediate surface section for engagement with and conveying clamping pressure onto the lower chord of the inner girder of an extensible girder unit, and means for engaging the lower chord of an outer girder of the extensible girder unit and said pressure member adjacent the intermediate surface section and for conveying clamping pressure thereto adjacent the intermediate surface section between the supporting surface sections.

It is yet another object of the present invention to provide in an extensible girder unit assembly having an outer girder with lower chords and an inner girder with a lower chord, a clamping device which comprises a wedge member having a top surface including two supporting surface sections spaced from each other in the longitudinal direction of the wedge member and an intermediate surface section between the supporting surface sections, said supporting surface sections elevated relative to said intermediate surface section for engagement with and conveying clamping pressure onto the lower chord of the inner girder of an extensible girder unit, the wedge member also having a bottom surface portion adjacent the intermediate surface section, and means for engaging the lower chords of an outer girder of the extensible girder unit and having an upper crowned surface for engaging the bottom surface portion of the

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wedge member and for conveying clamping pressure thereto adjacent the intermediate surface section between the supporting surface sections.

With these and other objects in view which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawing, in which:

FIGURE 1 illustrates a front view of a clamping means according to the present invention in the form of a clamping screw;

FIGURE 2 is a side view of FIGURE 1;

FIGURE 3 illustrates a side view of a modified clamping means according to the invention in the form of clamping wedges;

FIGURE 4 is a fragmentary view showing the connecting point of the clamping means of FIGURE 2 on the outer girder of an extensible girder unit;

FIGURE 5 is a perspective view of the clamping means of FIGURES 1 and 2 with the transverse bridge removed for the purpose of better demonstration; and

FIGURE 6 is an elevation of the extensible girder unit, showing a combination of the outer girder and the inner girder with a clamping device.

The clamping means according to the present invention for use in connection with extensible girder units, especially girder units with a lattice inner girder, is so designed that the clamping means rests on the lower chord of the inner girder by means of a pressure member in the form of a two-arm lever in such a way that the clamping force is conveyed to the lower chord at two supporting surfaces only which are located at the ends of the pressure member, while the point of attack of the clamping force is located between said supporting surfaces.

For the sake of completeness it may be mentioned that wedges have heretofore been employed as clamping means which wedges, however, rest along their entire length on the lower chord of the inner girder.

Moreover, pressure members have also been inserted between a pressure screw and the inner girder in order to distribute the pressure over the lower chord of the inner girder. However, in view of the elasticity of such wedges and pressure members, the pressure distribution is rather incomplete. In other words, there occurs, nevertheless, a more or less concentrated pressure transfer and thus a resultant force which the inner girder has to withstand at any portion thereof. This means that with a lattice inner girder, when this force attacks below a nodal point of the lattice-work (Case A), this force has to be absorbed solely by the diagonal braces meeting at the nodal point. The force is distributed over the diagonal braces meeting at two neighbouring nodal points when the point of attack is located between the two nodal points. In such an instance, however, in the lower chord of the inner girder there will occur a bending stress which is superimposed upon the tensile stress produced in the lower chord of the inner girder by the load resting upon the girder unit. This bending stress is greatest when the point of attack of the clamping force is located in the center between two nodal points (Case B).

With a clamping means according to the present invention and, for the sake of simplicity, a clamping means in which the distance between the supporting surfaces of the pressure member which convey the clamping force equals the distance between the nodal points in the lower chord of the inner girder, the following results are obtained. When the supporting surfaces conveying the clamping force are located below two nodal points (Case C), the clamping force is conveyed to twice as many diagonal braces as in the above discussed Case A. This means that with the present invention the diagonal braces require merely half the compressive strength and only

half the buckling strength as is necessary in Case A. This last mentioned fact is of particular importance because the admissible length of the diagonal braces decreases with the square of the buckling force. When the supporting surfaces of the pressure member, which convey the clamping forces, are located in the center between two nodal points (Case D), the clamping force is distributed over the diagonal braces of the neighbouring nodal points. In the diagonal braces which are located between the supporting surfaces of the pressure member, the force to be conveyed is the same as in the above mentioned Case C. Thus, the present invention makes it possible to better exploit the diagonal braces than is the case where the clamping force is conveyed to the lower chord of the inner girder at a single point only (Cases A and B). Furthermore, the bending stress which is superimposed upon the tensile stress produced in the lower chord by the load resting upon the girder unit is reduced to one half. This fact makes possible a reduction of the resistance moment of the lower chord cross section and permits a considerable saving in weight. Experience has also shown that by employment of the clamping means according to the present invention it is possible with the same load carrying capacity of the girder unit to obtain almost as low weights as were obtainable heretofore only with considerably more expensive light metal girders.

With an inner girder designed as a web plate girder, the pressure force acting at a point of the lower chord is distributed in the web in a fan-like manner to a pressure cone, the tip of which is located on the lower chord, whereas the base surface of the cone is located on the upper chord. With the clamping means according to the invention, however, the clamping force is conveyed in the form of two pressure cones. Thus, from the point of stress and thereby from the point of weight, corresponding advantages are obtained as with a lattice inner girder.

A further important reduction in the cost of production of the clamping means in the form of a pressure screw is obtained according to the present invention by the fact that:

(a) The clamping means designed in the form of a pressure screw and provided in a transverse bridge between the side cheeks of the outer girder has a head which widens toward the upper end upon which the pressure member rests;

(b) The bottom side of the pressure member is provided with protrusions embracing the head of said screw, the head being laterally insertable between said protrusions;

(c) The transverse bridge is provided with jaws located laterally of the pressure member, the pressure member being guided between the jaws in any working position thereof, and

(d) The screw has such a length that when occupying its highest position, the pressure member is adapted to be laterally slipped off from the screw head over the jaws of the transverse bridge.

In this way the parts of the clamping means, namely the transverse bridge, screw and pressure member, can be interconnected without any additional means or machining costs in such a manner that they cannot be lost. Moreover, this construction of clamping means makes possible a lateral guiding of the pressure member and thereby avoids the danger of a lateral bending of the clamping screw in view of the pressure exerted by the inner girder. Also if the pressure member is additionally provided with lateral jaws, the lower chord of the inner girder will be guided whereby it will be protected against lateral displacement and against buckling under the clamping force.

Referring now to the drawings, and in particular to FIGS. 1 and 2, the clamping means illustrated therein comprises a transverse bridge 7, a clamping screw 8 and a pressure member 23. Pressure member 23 has two sup-

porting surfaces 24 between which a depression 25 is provided, and has two lateral jaws or walls 26 for guiding therebetween the lower chord of the inner girder of an extensible girder unit, said lower chord resting on said supporting surfaces 24. The bottom side of said pressure member 23 is provided with two protrusions 27 of which the surfaces 28 facing each other form a part of a dove-tail-shaped recess.

The lower end of the clamping screw 8 is provided with an eye 29 for receiving a bolt or the like for turning the screw. The upper end of screw 8 has a head 37 of a truncated cone shape. The generatrices of the cone define the same angle as the surfaces 28 of the protrusions of pressure member 23 which embrace the screw head 37.

Transverse bridge 7 is provided with lateral jaws 30 between which the pressure member 23 is guided. The lateral jaws 30 have shoulders 31 by means of which the transverse bridge rests on the lower chords 6 (FIGS. 4 and 6) of the side cheeks of the outer girder of an extensible girder unit 2 and is welded by welding spot 38 to lower chords 6. The bottom surfaces 32 and 33 of the shoulders 31 form an angle with each other which corresponds to the bend or angle which the lower chord 6 of the outer girder 2 forms at the connecting point of the clamping means where said lower chord 6 leads upwardly to the upper chord 3 of the outer girder 2. This arrangement makes it possible to connect the transverse bridge 7 to the lower chord 6 of the outer girder 2 so that the axis of the screw passes through the nodal point of the lattice work of the outer girder 2. Advantageously, the width of the shoulders 31 at the point of attack of diagonal braces 5 of the outer girder 2 is dimensioned sufficiently small so that the shoulders 31 can be connected to the lower chords 6 of the outer girder and to the diagonal braces 5 by a single correspondingly large welding spot 38 as shown in FIG. 4. The lower chord 4 of the inner girder 4a rests on the supporting surfaces 24 of the pressure member 23 (not shown in FIG. 6) for better demonstration.

If screw 8 is screwed beyond the position illustrated in the drawing to such an extent that the lateral jaws 26 of the pressure member 23 are located entirely above the upper edge of the lateral jaws 30 of transverse bridge 7, the pressure member 23 may be slipped off laterally above one of the lateral jaws 30 off the head of screw 8. In this position of screw 8, when assembling the three parts of the clamping means, the pressure member 23 can be slipped laterally onto the head of the screw. Thereupon screw 8 is turned downwardly to such an extent that the pressure member 23 enters between the lateral jaws 30 of transverse bridge 7. In this way the parts of the clamping means are interconnected in such a manner that they cannot be lost.

When the clamping means occupies its position of operation, the pressure member is located below the illustrated position and is enclosed by the lateral jaws 30 of the transverse bridge. In order to be able to screw the pressure member from its operative position downwardly as far as possible by loosening screw 8, that portion of the transverse bridge which is provided with the screw thread is offset in downward direction with regard to the shoulders 31. This is of great advantage in order to obtain the necessary height of the free profile of the outer girder for the inner girder and the pressure member and for permitting the girder unit to be lowered a sufficient extent.

FIG. 3 illustrates a section through a transverse bridge 7a. As will be seen therefrom, bridge 7a has a curved supporting surface 34 for a pressure member 23a which occupies its operative position and is designed in the form of a wedge. Pressure member 23a differs from pressure member 23 of FIGS. 1 and 2 in that its lower surface 35 forms an angle with the plane in which the supporting surfaces 24 are located, said angle corresponding to the required lip angle of the wedge. Furthermore, instead of the protrusions 27 of the embodiment of FIGS. 1 and 2, the arrangement of FIG. 3 is equipped with abutments 36

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which prevent the wedge 23a from being knocked out of the transverse bridge 7a and thereby also prevents any danger of the wedge 23a getting lost.

While I have disclosed several embodiments of the present invention, it is to be understood that these embodiments are given by example only and not in a limiting sense, the scope of the present invention being determined by the objects and the claims.

What I claim is:

1. A combination comprising an extensible girder unit having an inner girder with a first lower chord and having an outer girder with spaced side cheeks each having a second lower chord and struts extending from said second lower chord to an upper chord and corresponding diagonal braces, a relatively long and narrow pressure member provided with two supporting surface sections spaced from each other in the longitudinal direction of said pressure member and an intermediate surface section between said supporting surface sections, said two supporting surface sections elevated relative to said intermediate surface section for engagement with and conveying clamping pressure onto said first lower chord of said inner girder, said pressure member having a bottom side provided with recess means adjacent said intermediate surface section, a rotatable screw bolt having a head detachably engaging said recess means for supporting said pressure member and conveying clamping pressure thereto, and a transverse bridge member including surfaces resting on said second lower chords of said side cheeks of said outer girder and provided with a threaded bore in threaded engagement with said threaded bolt, said surfaces of said bridge member having a contour complementary to said second lower chord, and said bridge member being arranged such, that the axis of said bolt passes through the nodal point of the outer girder.

2. The arrangement as set forth in claim 1, wherein said surfaces of said bridge member resting on said second lower chord comprise shoulders, said corresponding diagonal braces abutting each of said shoulders with said shoulders in sandwich arrangement between said second lower chord and said corresponding diagonal braces, said shoulders and said second lower chord of said corresponding side cheeks of said outer girder and said corresponding diagonal braces are interconnected by a single welding spot.

3. In an extensible girder unit assembly having an outer girder with lower chords and an inner girder with a lower chord, a clamping device comprising; a relatively long and narrow pressure member provided with two supporting surface sections spaced from each other in the longitudinal direction of said pressure member and an intermediate surface section between said supporting surface sections, for engagement with and conveying clamping pressure onto the lower chord of the inner girder of an extensible girder unit, and means for engaging the lower chords of an outer girder of said extensible girder unit and said pressure member adjacent said intermediate surface section and for conveying clamping pressure thereto adjacent said intermediate surface section between said supporting surface sections.

4. The clamping device as set forth in claim 3, in which said supporting surface sections are respectively located at the ends of said pressure member.

5. The clamping device as set forth in claim 3, in which said pressure member is tiltably supported by said means so as to form a two-arm lever with regard thereto.

6. In an extensible girder unit assembly having an outer girder with lower chords and an inner girder with a lower chord, a clamping device comprising; a wedge member having a top surface with two supporting surface sections spaced from each other in the longitudinal direction of said wedge member and an intermediate surface section between said supporting surface sections, said two supporting surface sections elevated relative to said intermediate surface section for engagement with and

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conveying clamping pressure onto the lower chord of the inner girder of an extensible girder unit, said wedge member including a bottom surface portion adjacent said intermediate surface section, and means for engaging the lower chords of an outer girder of said extensible girder unit and having an upper crowned surface for engaging said bottom surface portion of said wedge member and for conveying clamping pressure thereto adjacent said intermediate surface section between said supporting surface sections.

7. In an extensible girder unit assembly having an outer girder with lower chords and an inner girder with a lower chord, a clamping device comprising; a relatively long and narrow pressure member provided with two supporting surface sections spaced from each other in the longitudinal direction of said pressure member and an intermediate surface section between said supporting surface sections, said two supporting surface sections elevated relative to said intermediate surface section for engagement with and conveying clamping pressure onto the lower chord of the inner girder of an extensible girder unit, said pressure member including a bottom side provided with recess means adjacent said intermediate surface section, a rotatable screw bolt having a bolt head detachably engaging said recess means for supporting said pressure member and conveying clamping pressure thereto, and a bridge member provided with two spaced side walls mounted on the lower chords of an outer girder of said extensible girder unit, said bridge member having an upright threaded bore therethrough threadedly engaging said bolt to permit rotation of said bolt in said bore, and said bridge member provided with lateral guiding means laterally detachably retaining said pressure member.

8. The clamping device as set forth in claim 7, wherein said screw bolt has a length sufficient when extended relative to said bridge member so as to lift said pressure member out of said lateral guiding means of said bridge member thereby permitting lateral withdrawal of said bridge member from said bolt head.

9. The clamping device as set forth in claim 7, wherein said recess means is formed by a groove extending transverse to the longitudinal extension of said pressure member and having a dovetailed cross section, and said bolt head comprises an inverted truncated cone of a cross section conforming to said dovetailed cross section of said groove.

10. The device as set forth in claim 7, in which said bridge member has a downwardly extending offset portion in which said upright threaded bore is provided.

11. The clamping device as set forth in claim 3, wherein said pressure member has side walls extending in the direction of the longitudinal extension of said pressure member, and said side walls being spaced from each other in a direction transverse to the longitudinal extension of said pressure member for receiving therebetween said lower chord of said inner girder of said extensible girder unit.

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