Fig. 1

Fig. 2

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The invention relates to the art of building construction, and relates more particularly to truss girders for use in holding and supporting in place a prefabricated building element.

The use of prefabricated building elements, such as precast concrete units, is steadily gaining in importance in the building art. For example, there has already been a considerable use of thin slabs of a few centimetres thickness which contain all the reinforcement necessary for the subsequent intended use of the building and which are prefabricated in the factory. These prefabricated slabs are transported to the site and there are lifted with cranes into the building. In-situ concrete is then cast on to the slabs which, as mentioned, are already equipped with the reinforcement according to the floor thickness laid down in the plan. Thus, at the same time the slabs also serve as the shattering for the in-situ concrete.

As the concrete of the cast part which has already hardened and in-situ concrete cannot, however, form a monolithic structure, there remains with this type of floor construction between the two concrete layers cast at different times a separating joint which can support only relatively small shear stresses. In order to be able to utilize the full shear strength of the concrete, provisions must be made in the construction for the better bonding of the two layers of concrete of differing age.

For this purpose girders are mostly used in a framework type of arrangement which are located at intervals parallel to each other. This produces an additional advantage in that these girders substantially reinforce externally the thin prefabricated parts during the erection stage so that, on the one hand, precast parts with a much greater span can be transported and lifted at the building site and, on the other hand, the props necessary during concreting need be fewer in number and located at greater intervals.

The usual form of these girders, which consist of an upper and a lower chord and intermediate zig-zag shaped web members, has proved to be disadvantageous. Insofar as the reinforcement of the precast part is made, for example, of welded grating or mesh, this type of girder can only be laid on the mesh and joined to it with the aid of wire. The vertical components resulting from the shearing forces are thus taken up only by these weak wire joints.

Even if a hand made mesh reinforcement were used composed of longitudinal bars and of cross bars joined together manually by ordinary wire at the points of intersection, the introduction of the longitudinal rods of the mesh between the lower chord rods and the insertion of the cross members of the mesh through these is a time-consuming job.

It has therefore previously been proposed to provide framework girders wherein the diagonal web members are secured, for instance by welding, only with the upper chord, while the lower chord is connected by wire to the suitably formed diagonal ends. Also with this type of framework girder, however, much time consuming and hence expensive manual binding work is necessary.

It is accordingly among the principal objects of the invention to provide a girder that avoids the disadvantages of the prior art referred to, and is suitable for absorbing shearing forces between precast concrete parts and in-situ concrete parts during erection.

Generally, the invention accomplishes these objects by providing such a truss girder that has a top compression chord and a series of pairs of diagonal web members which are connected to the top chord, for instance by welding, and one member of each pair extends on each side of the girder, without any bottom chord, and the end parts of at least some of these members are bent inwardly horizontally in accordance with predetermined spacing dimensions and hold in pincer fashion a reinforcing element.

It is a further object of the invention to provide such girders in which the diagonal web members on both sides of the girder are of undulating shape.

It is still another object of the invention to provide such a truss girder in which the lower end parts of some of the web members project downwardly below the inwardly bent parts, to act as spacers.

Further objects and advantages of the invention will be set forth in part in the following specification and in part will be obvious therefrom without being specifically referred to, the same being realized and attained as pointed out in the claims hereof.

The instant invention is set out in the foregoing has the advantage that a reinforcing means such as a reinforcing element or mesh reinforcement which includes two parallel bars, may be held in pincer fashion between the diagonal web members on the two sides of the girder and the bars rest on the inwardly bent lower end parts of the web members. In this way the reinforcing element or mesh is positively held in position without any additional labor expenditure for tying with wire or the like and without special attachments, but nevertheless the force components resulting from truss forces in the vertical direction are transmitted to the diagonal web members of the girder.

The absence of the lower chord in the truss girder has the additional advantage that before the girders are attached to a sheet of mesh or other reinforcement, they may be bent in a vertical plane. Because every girder sags under its own weight and under the loading applied to it, it is customary for girders and other structural units to be deformed, such as arched, slightly to counteract the subsequent sagging of the magnitude of which can be determined by calculation. With the usual kind of girder which has diagonal web members attached rigidly both to the upper chord and to a lower chord, it is practically impossible to arch the girder to satisfy the particular
requirements. This difficulty does not occur with girders constructed in accordance with the instant invention because of the base with which they may be bent, and with them it is even possible to reinforce sharply curved structural units such as stiffening flanges in cylindrical shells.

Preferably the web members on both sides of the girder are formed from continuous undulating, such as zig-zag rods which are connected to the compression chord at their upper apices, and have some or all of their lower apices inwardly bent in V-shaped loops. The diagonal web members with inwardly bent lower end parts may alternate with diagonal web members in which the lower and parts are not inwardly bent but project downwards below the inwardly bent parts to act as spacers when the girder is placed on shuttering. When this is done, the inwardly bent parts of the diagonal web members on one side of the beam preferably coincide across the beam with unbent parts on the other side of the beam.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description, taken in connection with the accompanying drawings, in which:

FIG. 1 is a fragmentary perspective view of a framework girder without lower chord, in accordance with an embodiment of the invention.

FIG. 2 is a fragmentary perspective view, similar to FIG. 1, but embodying a modification;

FIG. 3 is a fragmentary perspective view, similar to FIGS. 1 and 2, but embodying a further modification; and

FIG. 4 is a fragmentary plan view of the modification of FIG. 2, in combination with a sheet of mesh reinforcement.

In carrying the invention into effect in the embodiments which have been selected for illustration in the accompanying drawings and for description in this specification, and referring now particularly to FIG. 1, there is provided a framework girder without lower chord; it has a round bar 1 as a compression chord to which on both sides designated with the prefix L on the left and R on the right are welded at intervals the upper apices of inverted V-shaped rods each of which forms two diagonal web members L1, L2 and R1, R2 on the appropriate side of the girder. This results in pairs of diagonal web members L1, R1; L2, R2 which lie one on each side of the girder and are joined together through intermediate welded connecting members 3. The lower end parts L1e, L2e and R1e, R2e of these diagonal web members are inwardly bent so that the distance a between the base lines of the tips of the inwardly bent ends of the diagonal web members is smaller than the interval a between the base lines FL and FR connecting each point on both sides of the girder about which the end parts of the diagonal web members are bent inwardly. Between the inwardly bent end parts it is therefore possible for a pair of reinforcing rods forming part of a sheet of mesh or of another reinforcing element (see FIG. 4) to be retained safely when the overall width across the bars is greater than the width corresponding to the interval a between FL–FR and FL–FR.

In the embodiment of the invention shown in FIG. 2, the diagonal web members on each side L and R of the girder are formed by individual sections of a continuous longitudinal rod bent into an undulating, such as a wave or zig-zag, shape the upper apices of which are welded to the compression chord 1. The diagonal web members lying opposite each other on both sides of the girder are again joined in pairs through welded intermediate transverse connectors 5. The lower end parts of adjacent diagonal web members in each side L2, L3 and R2, R3 are inwardly bent in a V-shaped loop 4. In the modification of FIG. 3, the bent free parts in V-shape alternate in each series of diagonals with unbent free end parts 4' so that each bent free part in one series of diagonals lies opposite an unbent free end part 4' in the series of diagonals on the other girder side and vice-versa. The unbent free end parts of the diagonals thus project below the bent free end parts 4 and therefore are able to act as supports or spacers when the girder is laid on shuttering. Since the reinforcement of reinforced concrete structural units must be provided with a layer of concrete or concrete cover, the height of the spacers formed in this way may be chosen according to requirements by a suitable selection of the bending points of the lower diagonal end parts.

In FIG. 4, the girder of FIG. 2 is shown combined with a reinforcing means, namely a ladder grid reinforcing mesh. It is a ladder grid made of double rods 5 with transverse connectors 6 welded between them in the longitudinal direction of the mesh and single rods 7 crossing the ladder shaped elements at right angles and welded to them at the respective points of intersection. The central double rod 5 is enclosed in finer fashion by the lower end parts 4 of the truss girder and is thus held in position. It is obvious that the interval between the two most external parallel longitudinal rods of the double rod 5 of the reinforcement enclosed in finer fashion by the bent diagonal end parts of both girder sides is greater than the clear interval a between the base line FL or FR of the inwardly bent diagonal end parts L2, L3 and R2, R3 and the base line FR or FL or the point of bending of the diagonal end parts of the other girder side L or R.

The attachment of the truss girder to the longitudinal rods of the reinforcing grid takes place by rotating the girder about its longitudinal axis and then pushing the girder lying at an angle to the mesh plane sideways towards the centre double rod 5 of the grid and then, as soon as both longitudinal rods of it are within the diagonal pairs, it is righted. Then the double rod is no longer able to slip through the pairs of diagonals.

The invention may be modified in various ways. In particular it is not necessary that the diagonals of the girder should run precisely symmetrically with the central plane of the girder.

We wish it to be understood that we do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having thus described the invention, what we claim as new and desire to be secured by Letters Patent is as follows:

1. A truss girder comprising a top compression chord and paired diagonal web members connected to the top chord, one member of each pair extending on one side of the girder, said girder being open at the bottom, at least some of the lower end parts of the diagonal web members being inwardly bent substantially horizontally, in combination with a reinforcing means including two parallel bars which are interconnected by transverse connectors, the overall width of said reinforcing means being such as to permit insertion through the open girder bottom of said reinforcing means relative to said girder so that the reinforcing means are operatively held in finer fashion between the diagonal web members of the two sides of the girder and rest on the inwardly bent lower end parts of the diagonal web members.

2. A girder according to claim 1, in which the diagonal web members on both sides of the girder are formed from continuous undulating rods connected to the compression chord at their upper apices and at least some of their lower apices being inwardly bent in V-shaped loops.

3. A truss girder, as claimed in claim 1, some of the lower end parts of said diagonal web members projecting downwardly from said girder sidewardly on one girder side L or R and being operable to act as supports when the girder is placed on shuttering.

4. A girder according to claim 1, in which inwardly bent lower end parts alternate with end parts projecting
5. A girder according to claim 1, in which the inwardly bent parts of the diagonal web members on one side of the beam coincide across the beam with unbent parts on the other side of the beam.

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