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(54) IMPROVEMENTS IN OR RELATING TO ASSEMBLIES OF PREFABRICATED, PRESTRESSED, REINFORCED CONCRETE ELEMENTS

(71) I, RENE SOUM, a French citizen, residing at 2 Rue Jolimont, 31 Toulouse, France, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates to assemblies of prefabricated, prestressed, reinforced concrete elements. It is applicable to the construction of all types of supporting structures.

In the case of joints intended to achieve continuity between girders, it is common practice to weld together the reinforcing rods projecting from the elements and to complete the joints by cementing them. Such a procedure, however, is slow and cumbersome, and does not allow for any standardisation of the ends of the elements to be assembled.

A device has also been proposed to ensure the transmission of tensile stresses between reinforcements by means of conical anchorages. This system, however, has the disadvantage that the cones gradually sink in, causing a loss of tension, and that they do not permit adjustment of the traction between the reinforcements.

Other systems have also been proposed which allow neither the prestressing of the reinforcements before the prefabricated elements are placed in position nor the adjustment of the stresses at the joint surfaces.

Finally, assembly devices have been proposed, using the same part according to whether the joint is girder to girder, girder on upright, or girder with girder on upright, the fitting operation consisting merely of tightening bolts. However, the elements to be assembled have a joint plane bisecting the angle between the longitudinal axes of the elements. This method results in a marked simplification and standardisation of the assembly operations, but its applications remain limited.

The present invention consists in an assembly of prefabricated, prestressed, reinforced concrete elements, wherein at least a pair of concrete elements is joined together

by linking means which comprises, respectively, one or two cage(s) and two or one externally threaded part(s) projecting into the cage(s) and secured thereto by means of nuts disposed within the cage(s) and screwed onto the threaded part(s), said nuts abutting against the cage(s) in ball and socket bearing arrangements, whereby to accommodate for misalignment of the pair of concrete elements.

The invention makes possible:

- prefabrication of structural elements,
- simplification of the prefabrication equipment,
- a high degree of flexibility in the dimensioning of the prefabricated elements,
- adaptation of the assembly device to the stresses set up,
- simplification of the assembly operations,
- adjustment of the assembly stresses,
- the achievement of resistance of the assemblies to positive and negative movements.

In a preferred embodiment of the invention, the linking means comprises a single cage containing two non-rotatable oppositely-handed nuts adapted to be screwed onto the projecting ends of the reinforcements of the concrete elements so that upon turning of said nuts and cage relatively to the reinforcements a supplemental stress is applied to the reinforcements. In this embodiment, the externally threaded parts are constituted by the projecting ends of the reinforcements.

In order that the invention may be more readily understood, reference will now be made to the accompanying drawings, in which:—

Figure 1 shows in section a first embodiment of the invention,

Figure 2 shows various types of assembly based on this first embodiment,

Figure 3 shows in section a second embodiment of the invention, and

Figure 4 shows various types of assembly based on this second embodiment.

[Price 33p]

As shown in Figure 1 of the drawings, two, prefabricated, pre-stressed, reinforced concrete elements each consist of a block of concrete M1 or M2 in which are embedded one or more reinforcements C or F. Solely for the purpose of illustrating the possibilities, reinforcement C is shown as having an externally threaded exposed or projecting end, while reinforcement F is secured to a metal anchor plate E which, in turn, carries an externally threaded stub D through which force can be applied to the main body F of the reinforcement. Between and fitting over the exposed ends C and D is a cage B within which are non-rotatably located two nuts A1 and A2 screwed onto the respective ends of the reinforcements. The two nuts are of opposite hand so that on rotation of the cage B and, hence, of the nuts A1 and A2, the two juxtaposed reinforcements are tightened or loosened.

The bearing of the nuts A1 and A2 on the interior end wall of the cage B is of the ball-and-socket kind so as to accommodate mis-alignment of the reinforcements.

The design is such that the cage and nuts can be fitted when the elements M1, C and M2, F have already been placed in position.

The linking means is applicable to the linkage of concrete girders P and uprights p, whatever their respective locations, as is shown in Figure 2. In the upper part of Figure 2 can be seen the joining of two girders on an upright; while the middle section shows the assembly of two girders on to both sides of an upright and supported on two flanges; and the lower section the joining of a girder and an upright.

Figure 3 shows two nuts 1a, 1b, with ball and socket bearings 2a, 2b on cages 3a, 3b, which, if retracted on a threaded rod 4 allow the insertion of the linking means after the prefabricated elements have been placed in position. The cages 3a, 3b are bolted to threaded nuts 5a, 5b which are either secured to an anchor plate 6 at the extremities of the stretched reinforcements 7 by means of a bolt 9 and a nut 10 embedded in the concrete, or all directly secured to the reinforcement 8. The first case is shown on the left of Fig. 3 and the second case on the right, where it is seen that tightening of the nut 5b on a metal distributing plate 11 supplements the previous stressing of the reinforcement 8.

The locking of the cages 3a, 3b causes the gradual stressing of the rod 4 and the rod 8 and bolt 9 and therefore creates a tensile stress between the plates 6 and 11, this tensile stress being regulated independently of the preliminary stresses in the prestressing reinforcements 7 and 8.

Fig. 4 shows how the linking means illustrated in Fig. 3 is applicable to the assembly of girders P and posts p, or to the assembly

of orthogonal girders, whatever their respective layout.

It will be seen that in the upper part of Fig. 4 that there is shown the assembly of two girders P laid on a post p. In the central part of Fig. 4, two girders P are shown joined on either side of the post p. In the lower part of Fig. 4, a girder P is joined orthogonally to the post p.

It will be seen in each of these different cases of Fig. 4 that the girders P always bear either on a shoulder 12 or on the top of the post p and that there is a free joint at the upper part between the girder P and the post p. The stressing of the rods 4, 8 and bolt 9 by rotating the cage creates a force which, taking into account this bearing of P on the shoulder 12, creates a variable moment or couple in the opposite direction to that which tends to open the joint through the effect of the weight of P and the vertical loads directed downwards and applied to P.

After tightening the cages, the variations of load on the girder P bring about the creation of moments in a plane at right angles to that of the assembly joint between P and p and, therefore, tensile stresses which are transmitted between prefabricated components through the linking means.

It will be appreciated from a comparison of the lefthand part of Figure 1 or Figure 3 with the right-hand part thereof that where there is reference herein and in the following claims to a nut being screwed onto the exposed end of a reinforcement, that exposed end may or may not be integral with the main body of the reinforcement: all that is necessary is that the force be applied to the exposed end shall be transmissible to the main body.

WHAT I CLAIM IS:—

1. An assembly of prefabricated, pre-stressed, reinforced concrete elements, wherein at least a pair of concrete elements is joined together by linking means which comprises, respectively, one or two cage(s) and two or one externally threaded part(s) projecting into the cage(s) and secured thereto by means of nuts disposed within the cage(s) and screwed onto the threaded part(s), said nuts abutting against the cage(s) in ball and socket bearing arrangements, whereby to accommodate for misalignment of the pair of concrete elements.

2. An assembly as claimed in claim 1, wherein the linking means comprises a single cage and two externally threaded parts which are secured respectively to the concrete elements.

3. An assembly as claimed in claim 1, wherein the linking means comprises two cages interconnected by a single externally threaded part and the cages are connected respectively to the concrete elements by



As shown in Figure 1 of the drawings, two, prefabricated, pre-stressed, reinforced concrete elements each consist of a block of concrete M1 or M2 in which are embedded one or more reinforcements C or F. Solely for the purpose of illustrating the possibilities, reinforcement C is shown as having an externally threaded exposed or projecting end, while reinforcement F is secured to a metal anchor plate E which, in turn, carries an externally threaded stub D through which force can be applied to the main body F of the reinforcement. Between and fitting over the exposed ends C and D is a cage B within which are non-rotatably located two nuts A1 and A2 screwed onto the respective ends of the reinforcements. The two nuts are of opposite hand so that on rotation of the cage B and, hence, of the nuts A1 and A2, the two juxtaposed reinforcements are tightened or loosened.

The bearing of the nuts A1 and A2 on the interior end wall of the cage B is of the ball-and-socket kind so as to accommodate mis-alignment of the reinforcements.

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2. An assembly as claimed in claim 1, wherein the linking means comprises a single cage and two externally threaded parts which are secured respectively to the concrete elements.

3. An assembly as claimed in claim 1, wherein the linking means comprises two cages interconnected by a single externally threaded part and the cages are connected respectively to the concrete elements by



further externally threaded parts which are secured to the concrete elements and onto which the cages are screwed.

4. An assembly as claimed in claim 1, 2 or 3, wherein the linking means is connected to reinforcements of one of the concrete elements by means of a metal plate to which the reinforcements are anchored and the linking means is secured.
- 10 5. An assembly as claimed in claims 3 and 4, wherein the plate is embedded in the concrete element and a bolt is connected to the plate by a nut, said plate being fixed to one of said further threaded parts by means
- 15 of the nut and bolt.
6. An assembly as claimed in claims 2 and 4, wherein the adjacent externally threaded part is screwed into the plate.
- 20 7. An assembly as claimed in any one of the preceding claims, wherein the linking means is connected to one reinforcement of one of the concrete elements.
8. An assembly as claimed in claims 2 and 7, wherein said one reinforcement forms
- 25 the adjacent externally threaded part.

9. An assembly as claimed in claims 3 and 7, wherein said further externally threaded part adjacent the said one reinforcement is internally threaded and is screwed onto said reinforcement.

10. An assembly as claimed in claim 9, wherein said one reinforcement is anchored to a metal plate embedded in the concrete element.

11. An assembly of prefabricated, prestressed, reinforced concrete elements substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawings.

12. An assembly of prefabricated, prestressed, reinforced concrete elements substantially as hereinbefore described with reference to Figures 3 and 4 of the accompanying drawings.

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