Sept. 8, 1970 A. BRANDESTINI ETAL 3,526,941

METHOD OF FASTENING ANCHORING MEANS TO A TENSIONING WIRE

Filed Sept. 17, 1968 2 Sheets-Sheet 1

Fig.1

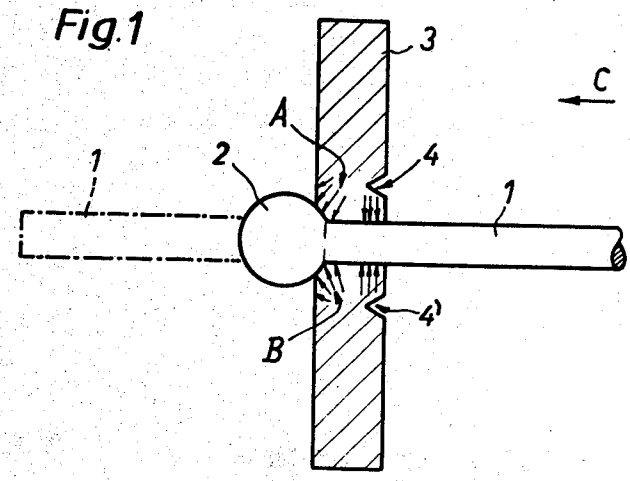


Fig.1a

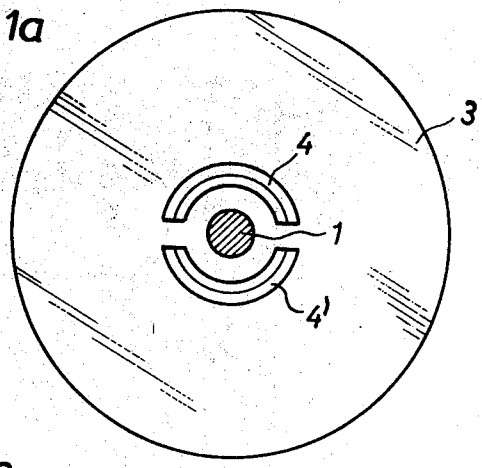
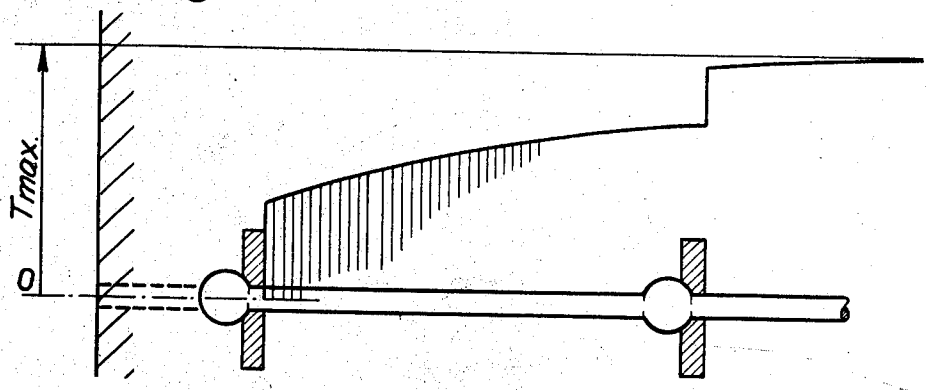


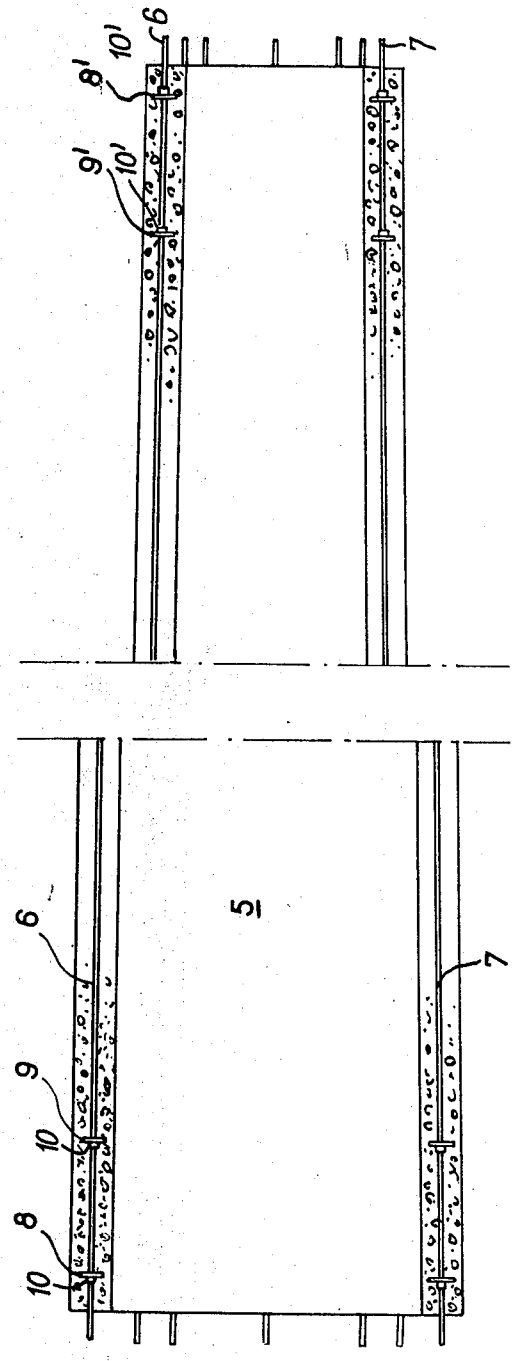
Fig.3



METHOD OF FASTENING ANCHORING MEANS TO A TENSIONING WIRE

Filed Sept. 17, 1968 2 Sheets-Sheet 2

Fig. 2



United States Patent Office 3,526,941 Patented Sept. 8, 1970

3,526,941

METHOD OF FASTENING ANCHORING MEANS TO A TENSIONING WIRE

Antonio Brandestini, 60 Alte Landstrasse, Kusnacht, Zurich, Switzerland, and Hans Rudolf Siegwart, Kilchberg, Switzerland; said Siegwart assignor to said Brandestini

Filed Sept. 17, 1968, Ser. No. 760,258
Claims priority, application Switzerland, Sept. 19, 1967, 13,132/67
Int. Cl. B23p 17/00, 11/00
U.S. Cl. 29—155 6 Claims

ABSTRACT OF THE DISCLOSURE

A method of fastening an anchoring element of steel to a tensioning wire for pre-stressed concrete structures, in which the steel element is threaded over the wire through a hole provided in the element and corresponding to the cross-section of the wire; an abutment or region of increased dimensions is then formed on the wire such that the element cannot slip over the abutment, the element is thrust against the abutment while simultaneously the element is subjected to external deformation to clamp the element to the wire.

The present invention relates to a method of fastening a steel anchoring element to a tensioning wire and to an associated anchoring termination.

The anchoring of tensioning wires or rods in concrete structures may be performed in two ways: by post-tensioning, in which the wire or bundle of wires to be tensioned is laid along the entire length of a concrete mould and is tensioned after the setting of the concrete, being subsequently braced against the concrete structure by means of a terminal anchoring device attached to the wire or bundle of wires; by pre-tensioning, in which one or more wires are tensioned against a so-called pre-tensioning bed or rigid form and anchored provisionally at their ends. After the concrete has set, the terminal anchoring devices are released to transfer the stressing force to the concrete by virtue of the adhesion between the wire surface and the concrete. In the case of post-tensioning, the force is taken up at the terminal anchoring device by virtue of the abutment of the latter against the concrete; in the case of pre-tensioning, however, the application of stress occurs by means of adhesion along a force application distance which depends on a variety of factors and which may amount to 30 to 40 times the diameter of the wire or rod. To enhance the application of stress by adhesion it has been suggested that the surface of the wire or rod be profiled, corrugated, or that wire strands be employed.

Many concrete structures occur however, in which neither of the above stressing systems is satisfactory, for example in the production of spin-cast prestressed tapered hollow concrete columns. This necessitates a spin-casting plant with robust external sheathing for the columns; in view of the spinning process the wires or rods must be laid and anchored temporarily in a spinning mould prior to casting the concrete. Since the costly spinning mould should be re-employed as soon as possible, it is necessary for the temporary terminal anchoring devices to be released with corresponding rapidity and for the relatively "callow" concrete to take up the loading force. Despite application of rapid setting or curing processes (e.g. steam curing), little success has hitherto been achieved in ensuring reliable stress application in thin-walled and consequently light-weight structures: sometimes there is no space for terminal anchoring devices of sufficient size, which have to be embedded in the concrete owing to the

risk of corrosion; or these may be too costly; or application of stress solely by adhesion cannot be justified in the still uncured concrete.

An object of the present invention is to provide a method of fastening an anchoring element to a tensioning or stressing wire or rod so that the advantages of both prestressing methods may be exploited and their shortcomings simultaneously eliminated.

The invention provides a method of fastening an anchoring element to a tensioning wire in which the element is threaded over the wire through a hole provided in the element and corresponding to the cross-section of the wire, a node-shaped abutment or region of increased dimensions is formed on the wire such that the element cannot slip over the said abutment or region of increased dimensions, the element is finally clamped to the wire by means of external deformation of the element with simultaneous thrusting against the abutment or region of increased dimensions.

Despite the constriction of the wire which occurs during tensioning, an anchoring element fastened to the wire in this manner will continue to remain clamped tightly to the wire at the prescribed point and will continue to bear against the abutment. Since the anchoring element takes up the constriction of the wire as a result of the internal elastic forces, it remains firmly clamped to the wire and pressed against the abutment. It is sufficient to deform the anchoring element in a region close to the wire.

The present invention thus combines anchoring by adhesion with a terminal anchoring system which may be provided with one or more subsidiary intermediate anchoring devices. To establish the combined anchoring action the terminal and intermediate anchoring devices are combined in a force-locked manner, that is to say the wire must not be allowed to slip until the terminal and intermediate anchoring devices come into action. This can be fully accomplished by the force-locked thrust of the anchoring elements against the abutments, e.g. upset terminal or intermediate heads, and by tightly clamping the anchoring element to the wire. To this end a plurality of small anchoring elements may be employed, the number and spacing of which may be arranged to suit the prevailing requirements.

The invention will be further described with reference to the accompanying drawings, in which:

FIG. 1 is a diagrammatic illustration of the end of a wire or rod on which an anchoring element has been fastened according to the invention;

FIG. 1*a* shows a view of FIG. 1 in the direction of the arrow C;

FIG. 2 illustrates a longitudinal section taken through a concrete post or the like prestressed by means of tensioning wires according to FIG. 1;

FIG. 3 is a diagram illustrating the wire/concrete application of stress in accordance with the invention at the end of a stressed concrete structure.

FIG. 1 shows a tensioning wire or rod **1** in the unstressed condition, the end or a part near the end of which is provided with a bulge **2** formed in some manner as by upsetting, and on which is clamped fast in a manner to be described a disc-shaped steel anchoring element **3**, so that the latter bears against bulge **2** in force-locked manner.

The following procedure is employed to fasten anchoring element **3** to wire **1**: the anchoring element **3** provided with a central hole corresponding to the cross-section of the wire is threaded over the wire **1**. The bulge **2** is formed in the wire behind the anchoring element by means of an appropriate device, after which the anchoring element **3** is clamped fast to the wire by external deformation with simultaneous thrust against bulge **2**. In the embodiment

shown this deformation is produced by a device which presses a circular notch or two semicircular notches **4, 4'** (FIG. 1*a*) into the anchoring element **3**, the material displaced thereby clamping anchoring element **3** firmly to the wire. The internal elastic strains generated in the areas A, B of the anchoring element ensure that the anchoring element **3** bears tightly against wire **1** and bulge **2**.

When wire **1** is subsequently tensioned a slight constriction consequently forms in the wire; nevertheless anchoring element **3** remains abutted against the bulge **2** and clamped to the wire thanks to the elastic strains, so that no relative displacement occurs between wire **1** and anchoring element **3**.

FIG. 2 shows at **5** a hollow concrete mast, pylon or the like made by a spin-casting process. The mast **5** is prestressed by means of a number of tensioning wires **6** and **7**. Two small anchoring plates **8, 9** and **8', 9'** are secured at the ends of each wire against abutments **10, 10'**. Thanks to these small anchoring plates, the cast and at least partially cured mast **5** may be stripped from the moulds after a relatively short time, since the present anchoring method ensures a reliable application of stress. This permits economical use to be made of the costly moulds or moulding machines.

The stress curve at the end of the concrete structure is illustrated in FIG. 3. In the example shown two anchoring elements are situated on the end portion of the wire, allowing transmission of a total tensioning force T_{max} by means of the wire.

Tensioning wires equipped with anchoring elements fastened according to the invention are particularly appropriate for thin-walled concrete structures, since there is no room in this case for anchoring plates of greater size.

In principle a common anchoring element may be employed for several wires.

We claim:

1. A method of fastening an anchoring element to a tensioning wire, said anchoring element being provided with a hole corresponding to the cross section of the wire, which method comprises threading said element over the wire, subjecting the wire end to an upsetting operation to form a node-shaped abutment on the wire between said element and the wire end such that the element cannot slip over said abutment, and then thrusting said element against said abutment while simultaneously subjecting the element to external deformation pressure for clamping the element to the wire.

2. A method as claimed in claim **1**, in which said element is deformed at a surface directed towards the portion of the wire to be disposed under tension.

3. A method as claimed in claim **1**, in which the deformation is performed in at least one area of said element close to the wire.

4. A method as claimed in claim **1**, in which the deformation takes the form of notches made in the surface of said element and extending concentrically with the axis of the wire.

5. A method as claimed in claim **1**, in which said element is disc- or plate-shaped.

6. A method as claimed in claim **5**, in which there are at least two of said elements fastened with a spacing from each other on each end of the wire.

References Cited

UNITED STATES PATENTS

2,177,191	10/1939	Sandberg	29—520
2,657,455	11/1953	Hillberg	29—155
3,075,272	1/1963	Buyken	249—214

THOMAS H. EAGER, Primary Examiner

U.S. Cl. X.R.

29—520; 52—223; 249—213