United States Patent [19]

Brandestini et al.

[11] **3,820,832**

[45] **June 28, 1974**

[54] **ANCHORING DEVICE FOR WIRE STRANDS IN PRESTRESSED CONCRETE STRUCTURES**

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[73] Assignee: **said Antonio Brandestini by said Siegwart and said Kaser**

[22] Filed: **May 10, 1971**

[21] Appl. No.: **141,674**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 806,571, March 12, 1969, abandoned.

[52] **U.S. Cl.** ..... **287/80,** 24/122.6, 24/126 R, 287/20.3, 52/223 L, 52/230

[51] **Int. Cl.** **F16g 11/04**

[58] **Field of Search** ... 24/126 C, 136 B, 126, 122.6, 24/126 R; 52/223 L, 230; 287/80, 82, 20.3

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[57] **ABSTRACT**

An anchoring device for wire strands in prestressed concrete structures wherein the end of the wire strand is upset to the shape of a head and the end portion of the strand together with the head is supported on the concrete structure by means of a clamping support inserted in a conical recess. The conical recess is provided in an anchor body embedded in the concrete structure and the clamping support is formed as a multipart wedging member supporting said head and inserted between the end portion of the strand and the conical wall of said recess to exert pressure on the end portion of the strand.

6 Claims, 5 Drawing Figures

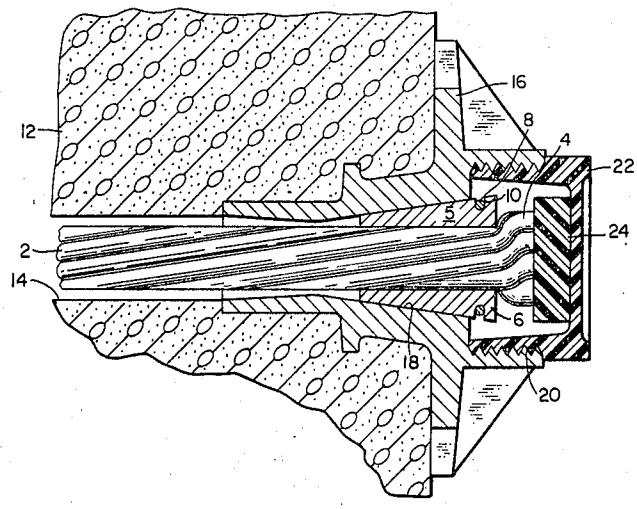




Fig. 1

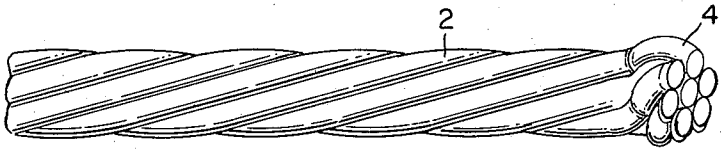


Fig. 2

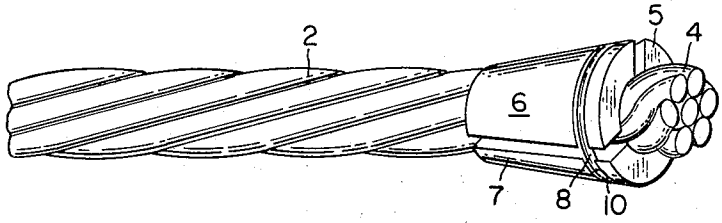


Fig. 3

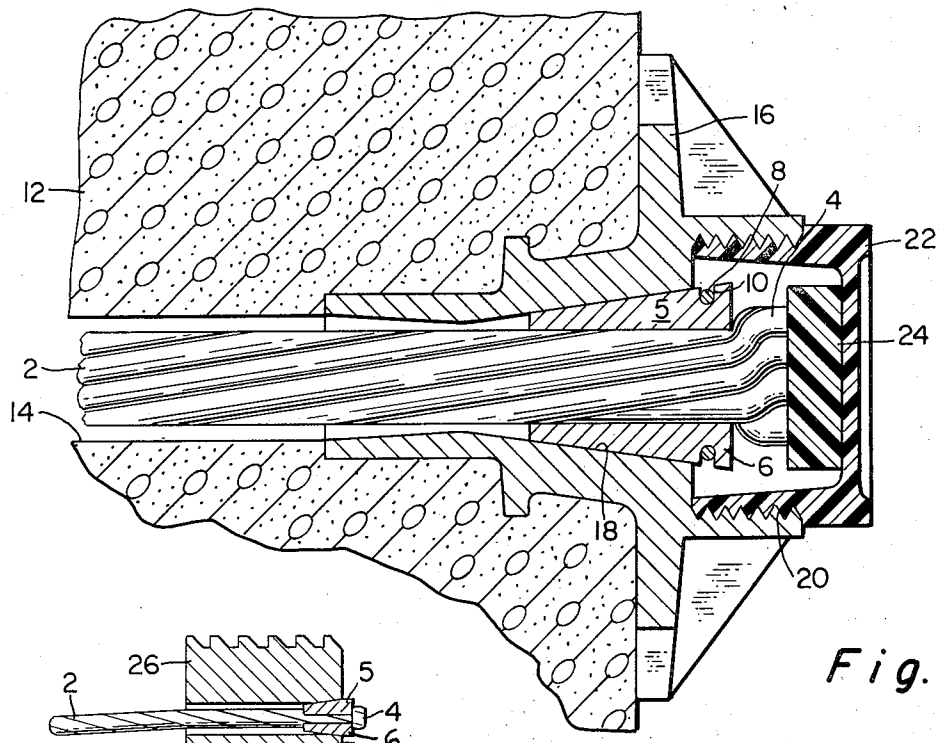


Fig. 4

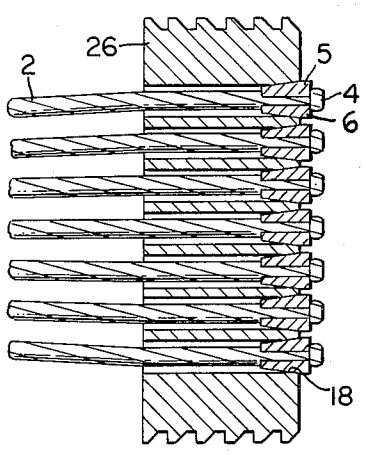


Fig. 5

ANCHORING DEVICE FOR WIRE STRANDS IN PRESTRESSED CONCRETE STRUCTURES

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a Continuation-In-Part of my co-pending application, Ser. No. 806,571 filed Mar. 12, 1969 now abandoned entitled "Anchoring Device for Wire Strands in Prestressed Concrete Structures."

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention related to the field of prestressed concrete structures, particularly the use of anchoring devices for anchoring wire strands used in prestressed concrete structures.

2. Description of the Prior Art

In a known kind of anchoring of wire strands used for prestressing of concrete structures strands are anchored by means of about two to four wedges resting in an anchor sleeve and engaging the circumference of the strand, the latter being retained solely by friction between its surface and the associated contact face of the wedges. This type of wedge anchoring, however, has quite a number of drawbacks, the most important are:

1. Prior to the wedges being able to take up the full tension or stressing force of the strand, there arises an undesired slip of the strand in the wedges which can be evaluated inaccurately only.

2. Upon jerky movements (when stressing the strands on the opposite side, overcoming of frictional forces, or upon vibration of any kind) it may happen that wedges which are already forced into position will be ejected.

3. In order that the strand will pull the wedges into the conical anchoring sleeve and accordingly assure the anchoring of the strand, the contact face bearing against the strand must be provided with a hard serrated surface. This serrated surface which compresses the strand owing to the wedging action, produces a damaging of the strand, which results in a reduction of the static and particularly of the dynamic strength of this manner of anchoring.

Such drawbacks do not occur in a positive, namely form-locking anchoring, which has become known in connection with single wires. Such wires are anchored at their end which has been upset to the shape of a head and is resting on a support. With this manner of anchoring, the above-mentioned drawbacks of the wedge anchoring do not occur; moreover, the limits of the loading capacity are dependent only on the tearing strength of the wires.

A comparison of the drawbacks of one anchoring type with the advantages of the other type would lead further to the idea of anchoring the strands used in prestressed concrete construction by means of small heads upset at their ends. However, it would be evident to the expert in the art, that the transfer of the manner of anchoring which was successfully used with single wires, to wire strands is not practicable or at least does not produce the same favorable result. In fact, numerous upsetting tests made with strands having different head shapes and head dimensions, with cold, hot and combined upsetting methods, with upsetting in several stages, etc., have not brought a satisfactory result, particularly not with the usual seven wires of e.g., 12–15 mm diameter. The upset small heads were overstressed,

and the loading capacity of the anchoring was far below the tearing strength of the strands.

However, the transfer of the positive anchoring which is usual with single wires is possible when the strand itself is not considered and treated as a single wire, but when it is recognized that the strand is formed by a number of single wires. It is accordingly possible to open the end of the strand and provide the exposed ends of the single wires each with a small upset head. The strength of such an anchoring would correspond to expectations, but its execution is complicated and expensive, since the exposed single wires, before starting the upsetting operation of the heads, must be passed through the holes of an anchoring plate.

SUMMARY OF THE INVENTION

It is an object of the invention to provide an anchoring device for wire strands which is considerably more reliable than conventional wire strand anchorings. According to the invention, the end of the wire strand is upset to the shape of a head, and the end portion of the strand is supported on the concrete structure by means of a clamping support inserted in a conical recess.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the end of a strand having seven wires;

FIG. 2 is a perspective view of an enlarged upset end area on a strand such as shown in FIG. 1;

FIG. 3 is a perspective view of wedge-shaped members installed on a strand such as shown in FIG. 2; and

FIG. 4 is a longitudinal cross-section through the anchorage combination according to the preferred embodiment of this invention;

FIG. 5 is a longitudinal cross-section through a perforated anchor body having a plurality of strands anchored in a single anchor body.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention will now be described in detail with reference to the accompanying drawings representing preferred embodiments of wire strand anchorings according to the present invention.

FIG. 1 shows one end of a strand **2** which is an example of a strand which can be anchored according to a preferred embodiment of this invention. FIG. **2** shows the strand of FIG. **1** having an enlarged upset end area **4**, and FIG. **3** shows multiple wedge-shaped members **5, 6, 7** assembled on strand **2**, and held there by a resilient element **8** (or snap ring) located in annular channel **10.**

FIG. **4** shows one end of a prestressed concrete structure **12** on which is supported a wire strand **2** of high strength composed, for example, of seven wires and passing through an opening **14** in the concrete structure. The strand **2** is provided at its end with an upset head **4.** The end of the strand **2** provided with the upset head **4** is supported on the concrete structure by a multipart wedge support **5,6** (e.g., three or four wedges can be provided), and by an anchor body **16** receiving the wedges **5, 6** in a conical recess **18,** the anchor body itself being embedded in an end wall of the concrete structure **12.**

The tension or stressing force of the strand **2** is partially transmitted to the wedges **5, 6** by the head **4** abutting against them and from there to the concrete structure, while another portion of the force is transmitted

by static friction from the strand 2 to the wedges and finally to the concrete structure.

Since only a portion of the total tension or stressing force has to be taken over by the head 4, the latter easily withstands the stress.

Since also a portion only of the total tension or stressing force must be transmitted by clamping action from the strand 2 by the frictional contact surfaces to the wedges 5, 6 and accordingly to the concrete structure, the compression force acting on the strand can be chosen smaller with respect to that required with pure wedge anchoring, which results in a reduction of the danger of damaging the strand.

Accordingly, the opening angle of the wedge support can be above the usual maximum value of about 15° and e.g., can be greater than 20°. Also, an extensively indented friction surface of the wedge is unnecessary.

Preferably, the opening angle of the conical recess 18 provided in the anchor body 16 is smaller than the opening angle of the wedge member 5, 6. In this manner the friction surfaces of the wedges 5, 6 predominantly abut against the section of the strand 2 situated near the head 4, and the transverse compression force exerted by the wedges on the strand at the exit of the strand, i.e., at the pointed end of the wedges, is relatively small, whereby a favorable distribution of the compression load acting on the strand is obtained.

Moreover, by the wedging action, the upset head 4, of the multiwire strand 2, is held together even under high load, and the bottom side of the head 4 is uniformly supported on the wedges 5, 6.

The wedges 5, 6 are made of a material having a strength or resistance preferably ranging from 80 to 160 kg/mm^2, and their frictional surfaces in contact with the strand conveniently are slightly roughened or coated with granules of hard material (e.g., carborundum granules) embedded in an adhesive.

As shown in FIGS. 3 and 4, the wedge-shaped member 5, 6, 7 have an annular channel 10 arranged to receive a resilient element 8 to assist in holding the wedge-shaped members 5, 6, 7 to the strand 2 during assembly of the anchoring device.

In a modification of the anchoring device which is composed of elements similar to those shown in FIG. 4, the diameter of the most narrow portion of the conical recess 18 or of the bore or opening 14 is greater than the greatest diameter of the head 4 upset on the strand 2. In this manner, it is possible to introduce the strand 2 in finished condition, i.e., with the head 4 already upset through the opening 14 of the concrete construction for the purpose of its anchoring.

Quite generally, it may be said that the head 4 can be upset on the strand 2 at any desired time, i.e., the strand can be supplied with at least one head 4 or the head 4 can be uspet later, e.g., after stressing of the strand 2 and wedging of the same.

In a further embodiment of the device, the anchoring body 16 may have an outward projecting attachment means 20 such as screw threads which are coupled to a closure means 22 or cap to protect the wedge-shaped members 5, 6, 7, and strand 2 from exposure to the weather. Additionally, a spacer 24 of resilient material, such as a plastic, can be secured between the end of the enlarged upset end area 4 and the inside end of the cap 22. The resilient spacer 24 assists in holding the enlarged upset end area 4 and the attached wedge-shaped members 5, 6, 7 into contact with the conical recess 18 whenever the strand 2 is not under sufficient tension for this purpose, such as during assembly of the components.

In a further embodiment as shown in FIG. 5, the anchor body can have numerous conical recesses 18 to form a perforated anchor body, each conical recess being adapted to receive the upset end area 4 and wedge-shaped members 5, 6, of corresponding strand 2 which may form part of a large cable.

From the foregoing, it can be readily realized that this invention can assume various embodiments. Thus, it is to be understood that the invention is not limited to the specific embodiments described herein, but is to be limited only by the appended claims.

What we claim is:

1. In a prestressed concrete construction in which a strand made of a plurality of wires twisted together is placed under tension, the combination comprising:

an anchor body arranged to be immovably positioned in a cavity in said concrete structure;

a conical recess in said anchor body;

a plurality of wedge-shaped members received in said recess, each of said members having an exterior portion formed substantially complemental to said conical recess, an end wall normal to the longitudinal axis of said strand and a friction area in snug engagement with said strand, the friction areas of the wedge-shaped members substantially completely encircling said strand, which is passed therethrough;

the end of the strand formed by the plurality of wires being formed into a single upset head permanently bent to form a laterally extending annular shoulder, said shoulder abutting and overlying a portion of said end walls of said wedge-shaped members, the head of the strand when the strand is under tension positively pushing said wedge members to slide along said conical recess to grip the strand, a portion of the tension force on the strand being transmitted to the wedge members by the enlarged head and the remaining portion of the tension force on the strand being transmitted by friction from the strand to the wedge members, the pull of the strand when under design load being substantially the sole force urging the enlarged head against the end wall of said wedge members.

2. The combination as claimed in claim 1, wherein the opening angle of the conical recess in said anchor body is smaller than the opening angle of the exterior portion of the wedges formed substantially complemental to said conical recess so that the gripping force of the wedge members on the strand is greater near the upset head than at the small end of the conical recess.

3. The combination as claimed in claim 1, wherein said wedge members include an annular channel area arranged to receive a resilient element to thereby facilitate assembly of said members with a strand.

4. The combination as claimed in claim 1, including a closure means coupled with said anchor body and enclosing said enlarged upset end head on said strand between said closure means and said anchor body.

5. The combination as claimed in claim 4, including a spacer of resilient material which is in contact and held between said closure means and the end of said enlarged upset end head on said strand.

6. The combination as claimed in claim 1, wherein said anchor body comprises a plurality of said conical recesses forming a perforated anchor body, each recess adapted to receive corresponding wedge-shaped members and corresponding strands with upset heads thereon.

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