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[54] **ANCHORING MEANS FOR TENSIONED MEMBER FOR HEAVY LOADS, FOR EXAMPLE, A SLANTED CABLE BRIDGE**

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[58] **Field of Search**.............................. 52/223–230, 52/220–221; 24/122.6

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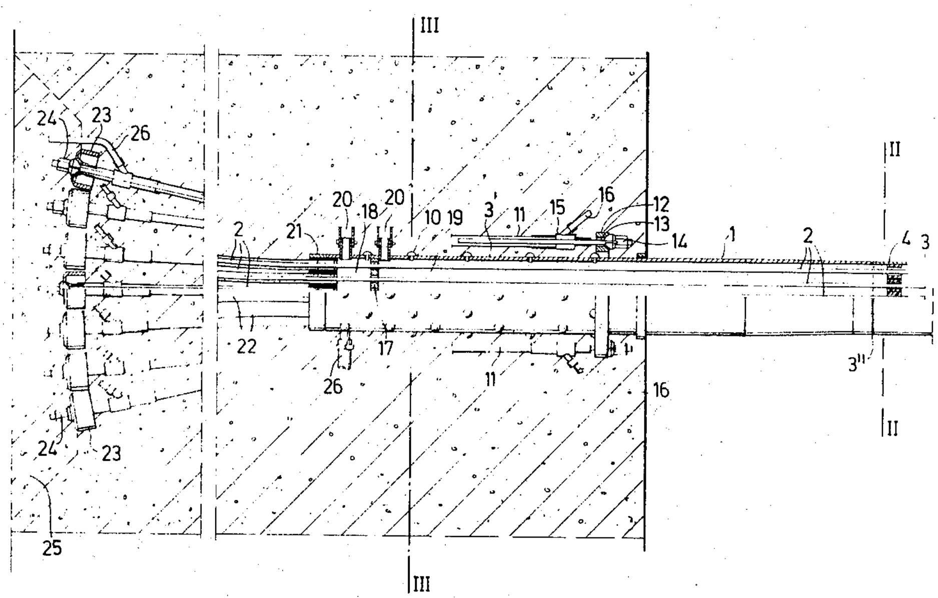
[57] **ABSTRACT**

Anchorage for a tensioned tension member for heavy loads in a concrete structure component such as a slanting cable of a slanted cable bridge comprising a plurality of parallel tension members such as wires or litz, that are arranged together in a common cover and surrounded by cement mortar that fills the space of the cross section of the cover not occupied by the tension member and which are fanned out in the direction of the anchorage, where the cover extends into the concrete structural part and is defined by a metal casing at least in the entrance area into the concrete part, and which, besides being connected with the tension members, is connected with the concrete part.

12 Claims, 3 Drawing Figures



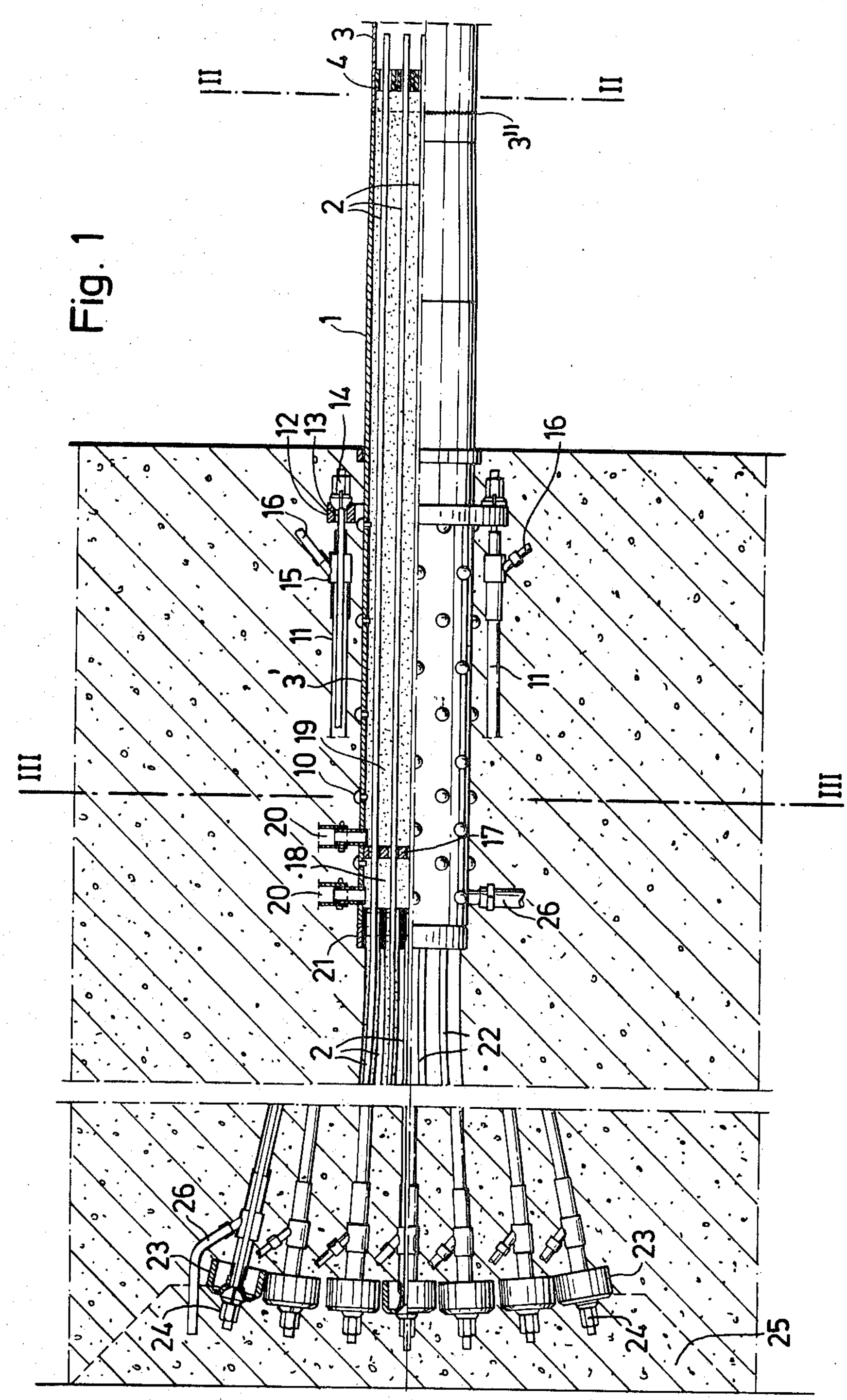


Fig. 1

Fig. 2

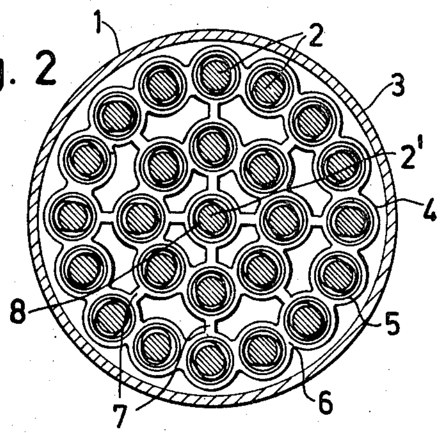
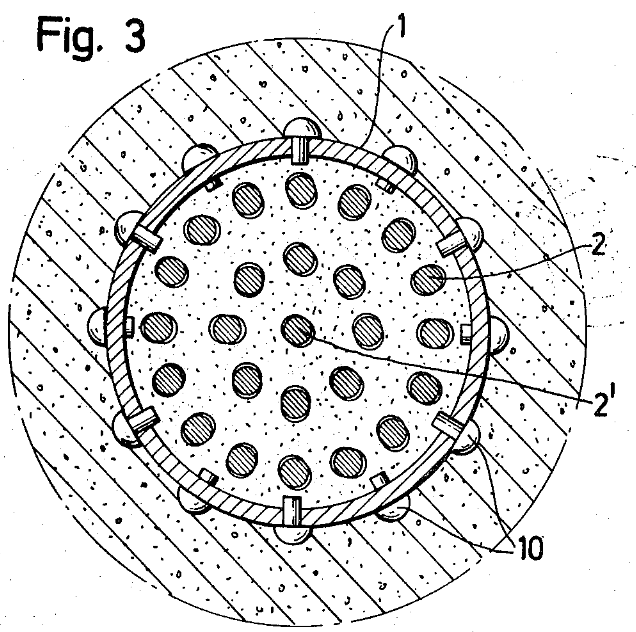


Fig. 3



ANCHORING MEANS FOR TENSIONED MEMBER FOR HEAVY LOADS, FOR EXAMPLE, A SLANTED CABLE BRIDGE

The invention relates to anchoring means for a tensioned member for heavy loads, for example, of a slanted cable bridge which consists of a plurality of parallel tension elements such as wires, litz or the like, that are arranged together in a cover or casing and surrounded by cement mortar which fills that part of the cross section of the casing that is not occupied by the tension member and which is filled in after the tensioning and which are fanned out in the direction of the anchorage.

Wire cables and bundles of thin drawn steel wire which are anchored in an anchoring head and can be tensioned as a whole or unit are known as tension members for heavy loads, for example, oblique cable bridges that extend externally of a building structure. With cables of a large number of wires individual wires are fanned out towards the anchorage generally in the manner of a broom and are placed in a conical casing of cast or forged steel and are there firmly embedded by means of a casting mass such as grouting. With tension members of steel wire bundles which are secured in anchor heads, for example, by means of wedge anchorages a similar method is used. For tensioning of tension members in this manner very expensive devices in the form of heavy tension presses are required, because all individual elements must be tensioned simultaneously.

It is already known in connection with a tension belt bridge to make the braces out of individual layers of closely packed steel bars which are accommodated in a boxlike covering. The steel bars are assembled by means of threaded sleeves that are staggered or displaced relative to one another in longitudinal direction and which at the same time serve as spacers. At the area of their entrance into the concrete construction the individual elements of the tension belts are fanned out and anchored by means of anchoring members, known per se in prestressed concrete construction art, at the outside of the concrete structure, i.e., at the bottom of the concrete runway plate. After the tensioning of the individual steel bars of the tension belts the remaining hollow space between the outer cover and the surface of the bars was pressed on with cement glue in order to attain corrosion protection.

Not only in this embodiment where the use of hot rolled, bar shaped tension members requires a large number of sleeve connections, the relatively low resistance to vibrations of the tension members that constitute the belts is objectionable. This is due in general to the fact that the anchorages of the tension elements are in addition to the static loads subjected to alternating loads caused by the traffic loads.

It is an object of the invention to achieve a form of construction of such a tension element which above all affords greater safety with respect to the vibration or oscillation loads, but where also the advantages of known tension members may be maintained with respect to the faultless corrosion protection by injection of cement mortar and the tensioning by means of simple and readily manipulated devices.

This problem is solved in accordance with the invention for a tension element of the type mentioned above in that the cover or casing extends into the structural concrete part and consists at least at the entrance area into the structural concrete part of a metal casing which besides being connected to the tension elements, is connected with the structural concrete part.

The improvement of the vibration resistance of the tension member which is of decisive importance above all for the endurance of a bridge is obtained in accordance with the invention by the separation of the introduction into the concrete structure of the permanent loads on the one hand and of the variable loads such as traffic loads on the other hand. This is obtained in that first the individual elements are tensioned in a known manner in their anchorages and are then anchored against the hardened concrete. In this manner the permanent loads of the dead weight which already exist are imparted in this load condition into the concrete structure. The traffic loads, i.e., the loads causing the vibration loads, arise only after the injection of the remaining hollow spaces with cement mortar or cement glue, i.e., at a time when a connection exists by way of the cement mortar between the individual elements, the metal cover and the part of the concrete structure in which the entire tension member has been anchored. These variable loads are then imparted to the metal cover or casing by way of the individual elements and are directly imparted by it to the concrete. Thus the actual anchorages of the individual elements will be freed of vibration loads to a considerable extent.

Furthermore, there exists the advantage that the individual elements are also individually anchored so that they can be tensioned with light and easily manageable tensioning devices. The advantages of the corrosion protection by injection with cement glue or cement mortar are known per se.

Suitably the metal cover has a constant wall thickness inside the concrete part and a decreasing wall thickness outside the concrete part. The part of the metal cover located inside the concrete part should on its inside and/or on the outside be provided with means for increasing the adhesion. For this purpose the wall of the metal cover may be provided with rivets.

Around the metal casing there may be arranged tension members extending essentially parallel thereto for producing a prestressing in the concrete surrounding the metal casing. These tension members may be anchored on an anchoring ring which encompasses the metal cover.

Suitably the covering consisting of metal or plastic material such as polyethylene is connected to the casing in a force transmitting and unitary manner.

The tensioning elements may be surrounded between the metal casing and their existing anchorage by hull tubes individually embedded in the concrete structure part. In the interior of the metal cover a perforated disk which permits the through-passage of the tension elements may be arranged, which together with an end plate which faces the anchoring bodies and encompasses the individual hull tubes forms an injection chamber.

The casing may be provided with spacing members for the parallel tensioning elements consisting preferably of plastic such as polyethylene, which are defined by a plurality of sleeves each enclosing a tension element arranged upon a number of concentric rings which are connected with each other and whose inner diameter is somewhat greater than the outer diameter of the tension elements.

One of the sleeves, preferably the one sleeve arranged in the center, may be provided with means whereby it is held on the tensioning element that passes through it.

The sleeve may have an internal thread by means of which it is threaded onto a tensioning element that has a corresponding thread. The length of the thread can be selected in a manner that it can be sheared off as the tensioning element is tensioned.

Further advantages and details of the invention will become apparent from the embodiment illustrated in the accompanying drawings in which:

FIG. 1 is a longitudinal section through the tensioning element in accordance with the invention in the area of the anchorage;

FIG. 2 is a cross section along line II—II of FIG. 1, and

FIG. 3 is a cross section along line III—III of FIG. 1.

The tensioning member **1** in accordance with the invention consists in the free area outside of the structural concrete part (right part of FIG. **1**) of a number of individual tensioning elements **2** which are arranged in the manner of an annulus inside a tubular cover **3** (see FIG. **2**). The tubular cover **3** may consist of plastic, for example polyethylene, or sheet steel. The tensioning elements are so arranged inside the tubular covering **3** that a tensioning element **2'** is disposed at the center and the remaining tensioning elements **2** are disposed around it in the manner of concentric rings. In the embodiment illustrated the tensioning elements **2, 2'** consist of rolled threads which are rolled to a diameter of 16 mm. so that in practice they can be supplied as endless wires. In the same manner it is also possible to utilize cables, litz wire or the like.

The individual tensioning elements **2** are kept at predetermined distances from one another by means of spacers **4** (FIG. **2**). The spacers **4** are made of plastic, for example polyethylene; they are composed of a number of sleeves **5** each of which encompasses an element **2** and are connected with one another by means of bridges **6** or **7**. The inner diameter of the sleeves **5** is greater than the outer diameter of the tension elements **2** so that the latter are freely moveable in longitudinal direction.

In the embodiment illustrated the tension elements **2, 2'** are provided at their outer surfaces with ribs that are disposed along a helical line and constitute an interrupted thread. The center sleeve **8** has an inner thread by means of which it can be screwed onto the center steel bar **2'**. In this manner the exact position of the spacer **4** upon the tension element **1** can be fixed. This thread is formeed in a manner that during tensioning of the tensioning elements **2, 2'** it may be sheared or cut off if necessary. When wires or litz wires having a smooth outer surface are used, the free opening of the sleeve disposed at the center point can be somewhat smaller than the diameter of the bar so that the sleeve is fixed on the bar in a wedging manner. Along a predetermined area before and after entrance of the tensioning element **1** into the concrete structure the casing is constructed as a steel cover **3'**. A possible seam location, for example a welded connection located between the free area of the sleeve tube **3** and the steel cover **3'**, is indicated at **3''**. The steel cover **3'** has constant wall thickness inside the concrete body. Outside of the concrete body the wall thickness and the outer diameter of the cover decreases continually until at the point **3''** it decreases to the thickness of the sleeve tube **3** in the free area.

The steel cover **3'** may be provided on its inner surface over the entire length and on its outer surface over the area embedded in concrete with adhesion increasing means. In the embodiment a rivet **10** has been subsequently placed in the steel cover **3'**.

In order to better absorb the high tension in the concrete body which develop during the introducion of the tension forces by way of the steel cover **3'** and to increase the protection against pulling the steel cover **3'** out of the concrete, further tension members **11** are disposed in annular fashion about the steel cover **3'** which extend generally parallel to the tension member **1** and are anchored in an anchoring ring **12**. The anchoring ring **12** is secured in position with respect to the tension member **1** only during the mounting; in the end condition no connection exists. The tensioning members **11** are passed through the bores **13** in the anchoring ring and are anchored on its outside by means of threaded nuts **14**. At the opposite side the tensioning members **11** which in FIG. **1** are not illustrated to full length for the sake of greater clarity are anchored in any manner known per se; if need be, they are also fanned out in the manner of the tension elements **2**. The tensioning members **11** are likewise provided in a manner known per se with hull tubes **15** and can be injected by way of channels **16**.

In order to achieve during the subsequent injection of the remaining hollow spaces with cement mortar or cement glue a faultless cover of the tension elements **2, 2'** thus to accomplish satisfactory corrosion protection, special provisions are made.

In the interior of the steel cover **3'** a perforated disk **17** is disposed in the proximity of the anchoring end which permits only the individual elements **2, 2'** to pass and otherwise constitutes a closed chamber **18**. During injection it is thus possible first to inject the hollow space from the opposite end of the tension member **1** in the free area thereof and into the hollow space **19** inside the steel cover **3'**; the enclosed air thus can exit from the aerating tubes **20**. Since these hollow spaces are relatively large, cement mortar may be used for the injection.

At the end the steel cover **3'** is closed off by an end plate **21**. Sleeve tubes **22** merge with the end plate **21** by means of which the tension elements **2, 2'** are surrounded up to their anchorages. These anchorages consist of known anchoring bodies **23** relative to which the tension members **2, 2'** that are provided with threads are fixed in place by means of threaded nuts **24**. The anchorages are provided in a recess **25** of the structural concrete part which after termination of all work is filled with concrete.

The small hollow space **18** formed by the perforated disk **17** at the end of the steel cover **3'** and the end plate **21** may be injected through a special closure stub **26** with liquid concrete glue. The concrete glue enters also into the hollow spaces between the tension elements **2, 2'** and their hull tubes **22** and may leave at the opposite end of the anchorage through the aerating tubes **26**. Flawless corrosion protection is thereby also afforded in this area.

Having now described our invention with reference to the embodiment illustrated in the drawings, what we desire to protect by letters patent is set forth in the appended claims.

We claim:

1. Anchorage for a stressed tension member for heavy loads in a part of a concrete structure, for example a slanted cable of a slanted cable bridge, comprising, in combination, a plurality of tension elements such as wires, litz or the like disposed parallel to one another, a common covering disposed around said elements, cement mortar or the like occupying the space of the cross-section in said covering not filled by said tension elements, said mortar or the like being introduced after tensioning of said elements, and said tension elements being fanned out in the direction of the anchorage and being individually anchored therein, said covering extending into said concrete structure part and comprising a metal casing in the area of entrance into said concrete structure part, said casing having a wall thickness that is constant inside said concrete structure part and decreases outside said concrete structure part, and besides being connected with said tension elements being also connected with said concrete structure part.

2. Anchorage in accordance with claim 1, where that part of said metal casing inside said concrete structure part is provided with means for increasing adhesion.

3. Anchorage in accordance with claim 2, where said means for adhesion are rivets provided on the wall of said metal casing.

4. Anchorage in accordance with claim 1 where said casing encloses perforated spacers for said tension elements enclosing a plurality of sleeves, each of which encompasses a tensioning element, said sleeves being connected with one another by bridges, and the inner diameter of said sleeves being greater than the outer diameter of said tension elements.

5. Anchorage in accordance with claim 4, where one of said sleeves, preferably the center sleeve, is provided with retaining means holding said sleeve on the tension element passing therethrough.

6. Anchorage in accordance with claim 5 where said retaining means are in the form of an internal thread on said sleeve and a corresponding external thread on said tension element.

7. Anchorage in accordance with claim 6 where said thread is of such length that it is adapted to be sheared off during tensioning of the tension element.

8. Anchorage in accordance with claim 1, comprising an anchoring ring having perforations encompassing said metal casing.

9. Anchorage in accordance with claim 8, comprising tensioning members disposed around said metal casing and extending parallel thereto and through the perforations in said anchoring ring for producing prestressing in the concrete disposed around said metal casing.

10. Anchorage in accordance with claim 9, where said covering is of metal, plastic such as polyethylene or the like, which is positively connected with said metal casing.

11. Anchorage in accordance with claim 10, comprising an anchoring body for each tension member embedded in said concrete structure part and sleeve tubes around said tensioning members extending between said casing and said anchoring members.

12. Anchorage in accordance with claim 11, including a perforated disk disposed inside said casing permitting passage of said tension elements, an end plate in said casing having apertures for said tension elements, said apertures extending around the ends of said sleeve tubes, said perforated disk and said end plate defining therebetween a chamber adapted to be injected.

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