Tension element for constructing a prestressed tension anchor in the ground with a connection between the surface of the tension member and the wall of a bore hole, which comprises a plurality of individual elements preferably in the form of bars extending along an anchoring stretch and a tensioning stretch and bunched together in bundle form along the anchoring stretch of the element without an outer casing and provided along the tensioning stretch with individual casings, where the connection is in the form of an injected hardening material and the elements are tensioned individually.
TENSION ELEMENT FOR CONSTRUCTING A PRESTRESSED TENSION ANCHOR IN THE GROUND

BACKGROUND OF THE INVENTION

The invention relates to structural elements for the construction of highways and bridges. More in particular, the invention is concerned with a tension element for constructing a prestressed tension anchor in the ground in order to produce a connection between the surface of the tension element in the region of an anchoring stretch at its end proximate the ground and the wall of the bore hole by injection of hardened building substances, for example, cement glue, and subsequent tensioning in the area of the free tensioning stretch.

Tension anchors in the ground are known in the form of single steel bars protected more or less against corrosion by painting or wrapping bands, or enclosing them in protective tubes, are inserted in corresponding bore holes, that by injection of hardening masses of, for example, cement glue in the area of the end of the steel bar proximate the ground a connection is established for anchoring, and that after hardening of the element being pressed the anchor bar is tensioned.

The advantage of these elements referred to as single bar anchors resides in that they are relatively easily manipulated and tensioned, and that the installation, as well as the control of the existing tensioning forces can be readily carried out. The shortcoming of such single bar anchors is considered to be in the anchoring force per bore hole being relatively small, i.e. that in one bore hole for the insertion relatively considerable expenses are necessary, while only limited anchoring force can be absorbed.

Furthermore, ground anchors are known that consist of a bundle of individual members, for example thin steel wires. The corrosion protection that is particularly important in connection with such bundles is usually obtained in that the space between the individual elements is filled with a corrosion preventing paste and the individual elements, for example steel bars, are thereupon wrapped with one or more layers of insulating and adhering strips or bands.

Anchors of this type provide the advantage of greater anchoring strength per bore hole as compared to single bar anchors. This means that in one bore hole a larger anchoring force can be anchored as compared to single bar anchors. However, they involve the shortcoming that it is necessary to anchor the anchoring force twice at the anchoring side of the structure. That is because it is necessary to anchor each individual element of the bundle first in the anchor head which supports itself against the actual anchoring plate which finally introduces the anchoring force into the structural component to be anchored. When the anchor is tensioned, all bars are tensioned simultaneously.

The large tension forces which arise in this connection complicate the tension operation considerably as compared to anchors made of single bars. The presses employed for tensioning which with anchors of single bars can be manipulated and serviced without difficulty by one man, weigh up to 200 kg, in connection with anchors of bundles of bars. For that reason they can only be serviced by means of suitable additional lifting equipment. Besides, the anchoring becomes considerably more expensive as a result of the twofold anchoring of the anchoring force in the anchoring head as compared to one anchoring of individual bars.

The anchors of bundles of bars involve the further short-coming that in the region of the anchors on the side of the structure the covering has to expand in trumpet fashion because the anchoring of the individual elements in the anchoring head always demands more space than the bundle in the area of the remaining length in which the individual elements may lie directly alongside one another so that it will not be necessary to make the bore hole larger than what is absolutely necessary. Such a trumpet-like expansion makes the installation of the bundle more difficult, and in spite of this requires frequently an enlargement of the diameter of the bore tube over the entire length.

Furthermore, damages may arise during tensioning of the anchor particularly in this area so that the deflection forces effective during tensioning cause tearing of the corrosion protection in the area of the trumpet shaped expansion. Furthermore, there exists the danger that due to the longitudinal movement of the anchors during tensioning, that may frequently amount to several centimeters, the protective cover is destroyed in the area of the trumpet-like expansion. An anchor thus damaged is then no longer sufficiently protected against corrosion.

A further problem exists at the transition from the anchoring stretch \( L_1 \) to the tensionable length \( L_2 \). At this transition location where the firmly concreted anchoring length \( L_1 \) meets the tensioning length \( L_2 \) of the anchor which is kept to be freely movable, a particularly reliable seal against the injected cement glue is required. This seal that can be provided without difficulty in anchors of individual bars encounters difficulty with bundle anchors because the space between the outer individual elements that are arranged in annular fashion cannot be reliably sealed. There exists the danger that during the injection operation injected mortar penetrates into the bundle, blocks a part of the free length of steel or prevents the individual elements from turning freely.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a possibility of obtaining a high tensioning force for each bore hole in such a ground anchor as, for example, a bundle anchor, while being able at the same time to employ handy presses as with an anchor of an individual steel bar and simultaneously insure safe protection against corrosion of the installed anchor.

In accordance with the invention this problem is solved with a tension member for producing a prestressed tension anchor in the ground by producing a connection between the surface of the tension element in the area of the anchoring stretch and the wall of the bore hole by injection of hardened construction materials, for example cement glue, in that the tension member is made of several individual elements, preferably in the form of steel bars which in the area of the anchoring stretch are assembled in bunched fashion and in the area of the tension stretch are individually provided with tubular covering, made preferably of plastic and are arranged to be individually tensionable in an anchoring device.

Preferably the individual elements are made of tensioning elements provided at least at the ends on the
structure side with threads and profiled along the remaining parts.

The profiling of the individual elements is suitably in the form of ribs which, in a known manner, are disposed along a helical path.

The advantage of the composite element in accordance with the invention where the individual elements are combined in bunches in the area of the anchoring stretch and are individually enclosed in the area of the tensioning stretch, resides in that several individual elements that are nevertheless individually tensionable can be arranged in one bore hole. The reverse forces that arise for the fanning in the structure side of the anchor can be absorbed more readily because they arise in the depth of the bore hole. Since each individual element is separately encased in the area of the free tension length an excellent corrosion protection is obtained.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features and advantageous characteristics of the invention will become apparent from the following specification of the embodiments illustrated in the accompanying drawings in which:

FIG. 1 is a longitudinal section of a ground anchor in accordance with the invention,

FIG. 2 is a cross-section along the line II—II in FIG. 1, and

FIG. 3 is a cross-section along the line III—III in FIG. 1.

DESCRIPTION OF THE INVENTION

The improved tension member for producing ground anchors can be utilized in any desired ground. In the embodiment described a rock anchor is shown where the actual anchor is composed of a plurality of bunched steel bars. The number of anchor bars can be adapted at any time to the carrying capacity of the anchor.

Prior to the installation of the tension member in accordance with the invention, a bore hole 1 is installed by using a bore or ram rod in a known manner. During this time the tension member 2 can be assembled outside the bore hole 1. The tension member in the embodiment shown comprises steel bars 3 that are arranged in a radially symmetrical manner and are held from one another in the correct positions by spacers. In the example a tube 4 is arranged in the center of the tension member 2 which may simultaneously serve for injecting the pressing mortar or grouting.

In the area of the anchoring stretch L_T the steel bars are held together merely by clamps or wrappers 5, otherwise they are freely disposed in this area. In the region of the free tension length L_S, the individual elements 3 are each surrounded by casing tubes 6 and, as a whole, they are held together by clamps or wrappers 5. The casing tubes 6 which are suitably made of plastic are individually sealed at their lower ends so that no mortar can penetrate into the interior of the tubes and impede the free expansibility of the anchor.

The tension member 2 thus prepared can in this condition be sunk into the bore hole. In this connection the individual elements 3 can together with the associated casing tubes 6 be somewhat drawn apart in the direction of the anchoring in order to provide space for placing the tensioning presses. The anchoring proper is effected by way of an anchoring plate 7 against which the anchoring nuts 8 of the individual tension bars 3 are supported. In order to obtain the inclination of the anchor relative to the structural component to be anchored, for example a bung element 9, a number of wedges 10 of different thickness may be installed. The object to be anchored, for example a building foundation bracing, is indicated at 11.

Upon installation of the tensioning element 2 in the bore hole 1, the hollow space in the area of the anchoring stretch L_T may be filled with cement glue by means of the injection tube 4. This then forms an anchoring body 12. The compression material may also extend along the free tension stretch L_S when it has been asserted that the free longitudinal movability of the individual anchor bars is assured. In order to ensure particularly in connection with ground anchors that the anchoring force acts fully on the ground, it is suitable that the cement glue is not under pressure in the free tension length L_S, but is merely filled in loosely.

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

I claim:

1. Tension element for producing a prestressed tension anchor in the ground by producing a connection between the surface of the tension anchor and the wall of a bore hole, said tension anchor comprising a plurality of individual elements in the form of bars extending along an anchoring stretch and a tensioning stretch, said bars being bunched together in bundle fashion along the anchoring stretch of the anchor without an outer casing and being provided along the tensioning stretch with individual casings in the form of tubes, said connection being in the form of an injected hardening material such as cement glue in the anchoring stretch between the surface of said tension anchor and said bore hole wall and said individual elements being separately tensionable.

2. Tension element in accordance with claim 1, where said elements are profiled and provided with threads at least at the ends proximate the structure being anchored.

3. Tension element in accordance with claim 2, where the profiling of the individual elements is defined by ribs disposed along a helical path.