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(54) **CONSTRUCTION METHOD AND STRUCTURE OF PRESSURE DISPERSING EXPANSION HEAD ANCHOR ROD**

(57) The present invention relates to a construction method and a structure of a pressure-dispersion type bit expanded anchor, belonging to the technical field of soil drilling of fixed buildings. The construction method adopts a drill rod to cut-drill in a jet spouting way in soil to form a water-pressure jet spouting cut-drilling segment and a cement-paste-pressure jet spouting cut-drilling segment, and the cement-paste-pressure jet spouting cut-drilling segment has a length of 2-4m and the cross section thereof has a maximum inner diameter of 600-800mm. By the structure, the water-pressure jet spouting cut-drilling segment and the cement-paste-pressure jet spouting cut-drilling segment are formed, and cement soil in the cement-paste-pres-

sure jet spouting cut-drilling segment gets hardened and encloses an anchor cable carrier and anchor cables. The cement-paste-pressure jet spouting cut-drilling segment formed by the construction method and the structure is short in length and large in the maximum cross section diameter, and the cement soil reserved in the cement-paste-pressure jet spouting cut-drilling segment has a high cement content. The cement-paste-pressure jet spouting cut-drilling segment has the advantages of high early cement soil hardening strength and a high anti-pulling bearing capability.

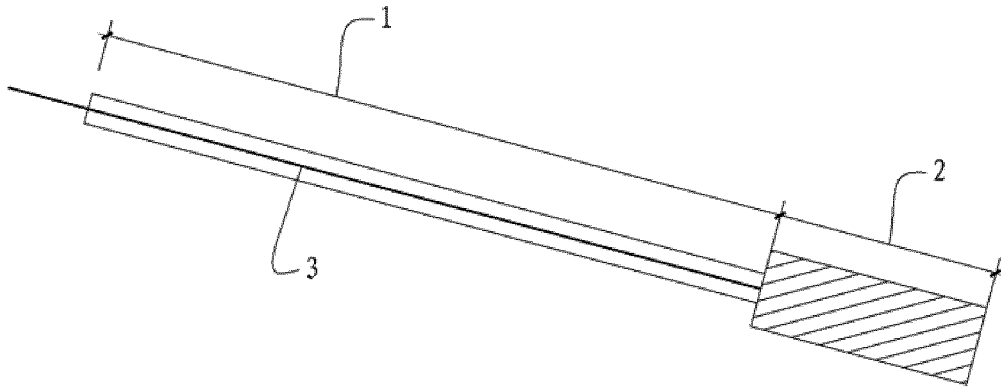


FIG. 3

Description

BACKGROUND OF THE INVENTION

5 TECHNICAL FIELD

[0001] The present invention relates to a construction method of a jet spouting anchor and a structure of the spouting anchor, belonging to the technical field of soil drilling of fixed buildings.

10 DESCRIPTION OF THE RELATED ART

[0002] Jet spouting anchoring is an effective soil body supporting, protecting and reinforcing technology, has been widely applied at home and abroad, and has advantages of low cost, quick effect, etc. A traditional jet spouting anchor is provided with a 5-10 long anchoring segment. The cement in the anchoring segment accounts for 12%-18%, and the strength of cement soil is relatively low in the 7-30 days. Due to the low strength, the anchor cannot be made into a pressure-type anchor, and can only be made as a tension-type anchor. The anti-pulling force of the anchor is provided by the lateral friction force between the anchoring segment and soil body. Limited by the low strength of the cement soil of the anchoring segment, the anti-pulling force of the anchor is usually low, obviously low in the soft soil, which fails to meet the engineering requirements of the tension standard for the short maintenance period of the anchor. Meanwhile, the tension-type anchor cables cannot be recycled through dismantling the core. Therefore, the traditional jet spouting anchor cannot be recycled through dismantling the core. The traditional jet spouting anchor always suffers from the problems of low anti-pulling force and failure to recycling through dismantling the core, which seriously affect the application of the traditional jet spouting anchor.

[0003] The construction method of the traditional jet spouting anchor is as follows: 1) A three-blade bit is used to perform water jet spouting, wherein the aperture is 150-200mm; the jet spouting is deep to the anchor bottom, without water pressure; 2) the drill rod and the bit exist, and a drill rod with a high-pressure nozzle is used to push the anchor body into an anchor hole; 3) after the anchor body is pushed in place, high-pressure cement paste jet spouting is carried out at a pressure of 15-25MPa; the drill rod exists along with the jet spouting; the jet spouted part is the traditional anchoring segment; the anchoring segment is 8-12m long; jet spouting is carried out one more time at a segment about 0.5-1m away from the end of the anchoring segment; the anchoring segment has a cement content of 110kg per meter; and 4) after the jet spouting of the anchoring segment ends, the drill rod exists.

[0004] See FIG. 1 and FIG. 2. The structure of a foundation pit support formed by a traditional jet spouting anchor and concrete pile walls includes a water-pressure jet spouting cut-drilling segment 1 and a cement-paste jet spouting cut-drilling segment 2. The cement paste in the cement-paste jet spouting cut-drilling segment 2 gets hardened and encloses an anchor cable carrier and one end of each of anchor cables 3, and the other end of each of the anchor cables 3 passes through the water-pressure jet spouting cut-drilling segment 1 and is fixed at an anchor head.

[0005] During construction, due to the needs of the construction period, the maintenance period of the anchor is merely about 7-21 days. In this way, the early strength of the anchor refers to the strength of the cement paste in the cement paste in the cement-paste jet spouting cut-drilling segment 2 in the 7-12 days. After making tests repeatedly, the applicant found that the traditional jet spouting anchor has the following problems:

[0006] The drilling speed of the drill rod of the traditional jet spouting anchor in the cement paste in the cement-paste jet spouting cut-drilling segment 2 is 25-50cm/min. Due to the quick jet spouting speed of the drill rod, the maximum inner diameter of the cross section of the formed cement paste in the cement-paste jet spouting cut-drilling segment 2 is similar to the inner diameter of the cross section of the water-pressure jet spouting cut-drilling segment 1. Besides, the cement in the cement paste in the cement paste in the cement-paste jet spouting cut-drilling segment 2 of the traditional jet spouting anchor accounts for 12%-18%, and the anti-pulling force of the traditional jet spouting anchor is generated by the friction force between piles and the soil body, so the traditional jet spouting anchor belongs to a tension-type anchor. For this reasons, in order to provide sufficient pulling bearing capability, the cement paste in the cement-paste jet spouting cut-drilling segment 2 is formed to be relatively long, thereby resulting in slow hardening of the cement paste in the cement paste in the cement-paste jet spouting cut-drilling segment 2 and low early strength of the traditional jet spouting anchor, and failing to provide sufficient anti-pulling bearing capability. Therefore, the traditional jet spouting anchor has a low anti-pulling force.

BRIEF SUMMARY OF THE INVENTION

[0007] The first technical problem to be solved by the present invention is to, aiming at defects in the prior art, provide a construction method of and a structure of a pressure-dispersion type bit expanded anchor which has high early cement coil hardening strength and a high anti-pulling bearing capacity.

[0008] The second technical problem to be solved by the present invention is to, on the basis of the first technical problem, provide a construction method of and a structure of a pressure-dispersion type bit expanded anchor with anchor cables which can be recycled by dismantling cores.

[0009] The first technical solution provided by the present invention to solve the first technical problem is a construction method of a pressure-dispersion type bit expanded anchor, wherein a drill rod is employed to perform cut-drilling through water-pressure jet grouting and cut-drilling through cement-paste-pressure jet grouting in soil in turn to respectively form a water-pressure jet grouting cut-drilling segment and a cement-paste-pressure jet grouting cut-drilling segment which communicate with each other from the inside to the outside, and the drill rod ends the cut-drilling through cement-paste-pressure jet grouting and then exits when reaching the tail end of the cement-paste-pressure jet grouting cut-drilling segment.

[0010] The cement-paste-pressure jet grouting type cut-drilling is one-time cut-drilling; when the one-time cut-drilling occurs, the drilling speed of the drill rod is controlled to be 4~8cm/min, and the length of the cement-paste-pressure jet grouting cut-drilling segment is controlled to be 2-4m, so that the maximum inner diameter of the cross section of the cement-paste-pressure jet grouting cut-drilling segment is 600-800mm; the ratio of the inner diameters of the water-pressure jet grouting cut-drilling segment and the cement-paste-pressure jet grouting cut-drilling segment is within the range of 0.2-0.4.

[0011] When the soil is clay, silty clay or floury soil, the amount of the cement paste used is controlled to be 1.0-2 ton such that the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment reaches 30%-40%.

[0012] when the soil is sandy soil, the content of the cement paste used is controlled to be 1-1.5 ton such that the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment reaches 15%-30%.

[0013] The cement soil in the cement-paste jet grouting cut-drilling segment gets hardened and fixes an anchor cable carrier and anchor cables; and when the hardening strength of the cement soil meets the tensioning and locking strength of a pressure type anchor, the maintenance period of the cements does not exceed 20 days.

[0014] In the present invention, the content of the cement mixed in the cement soil in the cement-paste-pressure jet grouting cut-drilling segment is determined according to the mass percentage of the soil body in the cement-paste-pressure jet grouting cut-drilling segment as required in the design. The mass of the soil body per stere is generally 1,600-2,000kg. When the soil is clay, silty clay or floury soil, the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment is 30%-40%; and when the soil is sandy soil, the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment is 15%-30%.

[0015] According to the present invention, the drill rod is employed to perform cut-drilling through water-pressure jet grouting and cut-drilling through cement-paste-pressure jet grouting in soil in turn; the cement-paste-pressure jet grouting type cut-drilling is the one-time cut-drilling; when the one-time cut-drilling occurs, the drilling speed of the drill rod is controlled to be 4-8cm/min, and the length of the cement-paste-pressure jet grouting cut-drilling segment is controlled to be 2-4m, so that the maximum inner diameter of the cross section of the cement-paste-pressure jet grouting cut-drilling segment is 600-800mm; the ratio of the inner diameters of the water-pressure jet grouting cut-drilling segment and the cement-paste-pressure jet grouting cut-drilling segment is within the range of 0.2-0.4.

1) The present invention provides a pressure type anchor, while the traditional jet spouting anchor is a tension type anchor, different in the stressing mechanism. The anti-pulling resistance of the anchor provided by the present invention depends on the lateral friction force of the hardened cement soil in the cement-paste-pressure jet spouting cut-drilling segment and the end bearing capability generated by the cross section of the hardened cement soil, greatly improving the anti-pulling capability. The technology can be utilized in a stable soil layer as an anchoring segment, thereby giving a full play to the end bearing capability of the pressure-type anchor and ensuing small discreteness of the anti-pulling force.

2) The drilling speed of the drill rod in the present invention is controlled to be 4-8cm/min, far smaller than the jet spouting cut-drilling speed of the traditional jet spouting anchor, so the maximum inner diameter of the cross section of the cement-paste-pressure jet spouting cut-drilling segment is 600-800mm. In this way, the bearing capability of a single anchor cable is enhanced, increasing safety rating and improving the initial pre-stress of the anchor at the same time. Therefore, the deformation of supporting and protecting structures can be better controlled.

3) The cement-paste-pressure jet spouting cut-drilling of the present invention is one-time drilling, and the cement-paste-pressure jet spouting cut-drilling of the traditional jet spouting anchor is two-level drilling. The present invention reduces the drilling times.

4) When the soil is clay, silty clay or floury soil, the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment reaches 30%-40%; and when the soil is sandy soil, AND the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment reaches 15%-30%, far higher than the content of the mixed cement mixed in the cement paste in the traditional jet spouting anchor structure, equivalent to that, without increase in the cement amount, the cement is completely used in a 2-4m cement-paste-pressure jet grouting cut-drilling segment to perform high-cement-ratio jet spouting replacement in the present invention. The present invention directly gets the point, so the cement-paste-pressure jet grouting cut-drilling segment has advantages of a small length, a large diameter and a high cement ratio, directly enhancing the cement soil strength and early strength of the anchoring segment of the anchor of the present invention. During actual engineering construction, the maintenance time for the cement soil strength of the cement-paste-pressure jet grouting cut-drilling segment to increase to the designed strength is reduced, and the long-existing problems of low cement soil strength and low early strength of the traditional jet spouting anchor, and problem of failure to manufacture the pressure are completely solved.

5) The cement paste in the cement-paste-pressure jet grouting cut-drilling segment overflows to fill in a part of the water-pressure jet spouting cut-drilling segment, and the content of the mixed cement of the part in the water-pressure jet spouting cut-drilling segment is (5%-10%), so the strength is higher than the original soil.

[0016] The second technical solution provided by the present invention to solve the first technical problem is a structure of a pressure-dispersion type bit expanded anchor, wherein the construction method of a pressure-dispersion type bit expanded anchor according to claim 1 is adopted to respectively form a water-pressure jet grouting cut-drilling segment and a cement-paste-pressure jet grouting cut-drilling segment which communicate with each other from the inside to the outside; the cement paste in the rotary cement-paste-pressure jet grouting cut-drilling segment gets hardened and encloses an anchor cable carrier and an anchor cable; the length of the cement-paste-pressure jet grouting cut-drilling segment is controlled to be 2-4m; the maximum inner diameter of the cross section of the cement-paste-pressure jet grouting cut-drilling segment is 600-800mm; and the ratio of the inner diameters of the water-pressure jet grouting cut-drilling segment and the cement-paste-pressure jet grouting cut-drilling segment is within the range of 0.2-0.4:

[0017] When the soil is clay, silty clay or floury soil, the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment is 30%-40%.

[0018] When the soil is sandy soil, the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment is 15%-30%.

[0019] In order to solve the second technical problem, the present invention makes the following improvement on the above technical solution: the anchor cable carriers are at least two carriers which are fixed in the hardened cement soil in the cement-paste jet grouting cut-drilling segment at an interval along the length direction of the cement-paste jet grouting cut-drilling segment; the anchor cables are anchor cables provided with membranes; the anchor cable carriers are hinge type carriers or flat plate type carriers; when the anchor cable carriers are hinge type carriers, anchor cables are coiled on the hinge type carriers in U-shape; and when the anchor cable carriers are flat plate type carriers, each flat plate type carrier is fixed with a fused anchor fixture for holding one end of an anchor cable.

1) The anchor cable carriers are at least two carriers which are fixed in the hardened cement soil in the cement-paste jet grouting cut-drilling segment at an interval along the length direction of the cement-paste jet grouting cut-drilling segment; and the anchor cable carriers are hinge type carriers or flat plate type carriers; when the anchor cable carriers are hinge type carriers, anchor cable. Compared with the prior art where a single anchor cable carrier fixes a plurality of anchor cables, the stress is dispersed when at least two anchor cable carrier is adopted, so the anchor belongs to a load-dispersing type anchor. 2) When the anchor cable carriers are hinge type carriers, anchor cables are coiled on the hinge type carriers in U-shape, and after the engineering construction is ended, one end of each of the anchor cables can be released through the hinge type carrier to recover the anchor cables; when the anchor cable carriers are flat plate type carriers, each flat plate type carrier is fixed with a fused anchor fixture for holding one end of an anchor cable, and after the engineering construction is ended, one end of each of the anchor cables can be released through the fused anchor fixture, which means that the present invention can recover the anchor cables by dismantling the core, and the traditional jet spouting anchor cannot recover the anchor cables by dismantling the core. 3) The anchor is provided with membranes, and the anchor cables are non-adhesive anchor cables, so all the front ends of all the anchor cable carriers are free ends, capable improving the requirements for the initial pre-stress on the anchor of the present invention (1.1 times the designed value, 1.0 time higher than the standard value), thereby realizing testing of every cable, reducing the pit displacement and achieving the effect safer than supports.

[0020] The first change of the first technical solution is as follows: The anchor cable carriers is on anchor cable carrier

which is fixed in the hardened cement soil in the cement-paste jet grouting cut-drilling segment; the anchor cables are anchor cables provided with membranes; the anchor cable carrier is a hinge type carrier or flat plate type carrier; when the anchor cable carrier is a hinge type carrier, the anchor cable is coiled on the hinge type carrier in U-shape; and when the anchor cable carrier is a flat plate type carrier, the flat plate type carrier is fixed with a fused anchor fixture for holding one end of an anchor cable.

[0021] The second change of the first technical solution is as follows: The drill rod brings the anchor cable carrier and the anchor cable in when drilling.

[0022] The third change of the first technical solution is as follows: After the drill rod ends the cut-drilling through cement-paste-pressure jet grouting and then exits, the anchor cable carrier and the anchor cables are brought in the cement-paste jet grouting cut-drilling segment in the non-jet-spouting state.

[0023] The fourth change of the first technical solution is as follows: The tensioning and locking strength of the pressure-type anchor is greater than 2Mpa.

[0024] The fifth change of the first technical solution is as follows: The inner diameter of the cross section of the water-pressure jet-spouting cut-drilling segment is 150-200mm.

[0025] The sixth change of the first technical solution is as follows: The water pressure of the rotary water jet spouting cut-drilling is 2-15MPa; the cement paste pressure of the rotary cement paste jet spouting cut-drilling is 15-30MPa; and the water-cement ratio of the cement paste is 1.0-1.5.

[0026] The seventh change of the first technical solution is as follows: When the drill rod ends the cut-drilling through cement-paste-pressure jet grouting and then exits after reaching the tail end of the cement-paste-pressure jet grouting cut-drilling segment, the cement-paste-pressure jet grouting cut-drilling segment is supplemented with the cement paste at a low pressure; when the anchor has a waterproof curtain, the cement paste is grouted at a pressure of 0.5-2MPa at the junction of the waterproof curtain.

[0027] The eighth change of the first technical solution is as follows: The length ratio of the cement-paste jet grouting cut-drilling segment to the water-pressure jet grouting cut-drilling segment is 0.06-0.3.

[0028] The first change of the second technical solution is as follows: The anchor cable carriers are at least two carriers which are fixed in the hardened cement soil in the cement-paste jet grouting cut-drilling segment at an interval along the length direction of the cement-paste jet grouting cut-drilling segment; the anchor cables are anchor cables provided with membranes; the anchor cable carriers are hinge type carriers or flat plate type carriers; when the anchor cable carriers are hinge type carriers, anchor cables are coiled on the hinge type carriers in U-shape; and when the anchor cable carriers are flat plate type carriers, each flat plate type carrier is fixed with a fused anchor fixture for holding one end of an anchor cable.

[0029] The second change of the second technical solution is as follows: The anchor cable carriers is on anchor cable carrier which is fixed in the hardened cement soil in the cement-paste jet grouting cut-drilling segment; the anchor cables are anchor cables provided with membranes; the anchor cable carrier is a hinge type carrier or flat plate type carrier; when the anchor cable carrier is a hinge type carrier, the anchor cable is coiled on the hinge type carrier in U-shape; and when the anchor cable carrier is a flat plate type carrier, the flat plate type carrier is fixed with a fused anchor fixture for holding one end of an anchor cable.

[0030] The third change of the second technical solution is as follows: The length ratio of the cement-paste jet grouting cut-drilling segment to the water-pressure jet grouting cut-drilling segment is 0.06-0.3.

[0031] As a change of the above technical solution: The cement used for making the cement paste is cement with a common strength rating or a high-mark cement with a strength rating of 52.5Mpa or above.

[0032] The applicant found that, compared with cements with a common strength rating, for example, the cement with a rating of P.o.42.5, the high-mark cement with a strength rating 52.5Mpa or above can obviously improve the early bearing capability of the anchor and improve the early strength of the anchor.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0033] The present invention is described in further detail with reference to the attached drawings.

FIG. 1 is a structural view of a traditional jet-spouting anchor.

FIG. 2 is a structural view of a foundation pit support formed by the traditional jet-spouting anchor and concrete pile walls.

FIG. 3 is structural view of a pressure-dispersion type bit expanded anchor according to an embodiment of the present invention.

FIG. 4 is a structural view of a foundation pit support formed by the pressure-dispersion type bit expanded anchor

and concrete pile walls.

FIG. 5 is a schematic view of structures of a water-pressure jet spouting cut-drilling segment and a cement-paste-pressure jet spouting cut-drilling segment of the traditional jet spouting anchor.

FIG. 6 is a schematic view of structures of a water-pressure jet spouting cut-drilling segment and a cement-paste-pressure jet spouting cut-drilling segment of the pressure-dispersion type bit expanded anchor of the present invention.

FIG. 7 is a comparison diagram of the strength-age increase of the structure of the pressure-dispersion type bit expanded anchor of the present invention and the structure of the traditional jet spouting anchor.

DETAILED DESCRIPTION OF THE INVENTION

EMBODIMENT

[0034] A construction method of a pressure-dispersion type bit expanded anchor of this embodiment, as shown in FIG. 3 and FIG. 4, adopts a drill rod to perform cut-drilling through water-pressure jet grouting and cut-drilling through cement-paste-pressure jet grouting in soil in turn to respectively form a water-pressure jet grouting cut-drilling segment 1 and a cement-paste-pressure jet grouting cut-drilling segment 2 which communicate with each other from the inside to the outside, the drill rod ending the cut-drilling through cement-paste-pressure jet grouting and then exiting when reaching the tail end of the cement-paste-pressure jet grouting cut-drilling segment 2.

[0035] The cement-paste-pressure jet grouting type cut-drilling segment 2 is one-time cut-drilling segment; when the one-time cut-drilling occurs, the drilling speed of the drill rod is controlled to be 4-8cm/min, and the length of the cement-paste-pressure jet grouting cut-drilling segment 2 is controlled to be 2-4m, so that the maximum inner diameter of the cross section of the cement-paste-pressure jet grouting cut-drilling segment is 600-800mm; and the ratio of the inner diameters of the water-pressure jet grouting cut-drilling segment 1 and the cement-paste-pressure jet grouting cut-drilling segment 2 is within the range of 0.2-0.4.

[0036] When the soil is clay, silty clay or floury soil, the content of the cement paste used is controlled to be 1.0-2 ton such that the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment 2 reaches 30%-40%.

[0037] When the soil is sandy soil, the content of the cement paste used is controlled to be 1-1.5 ton such that the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment 2 reaches 15%-30%.

[0038] The cement soil in the cement-paste jet grouting cut-drilling segment 2 gets hardened and fixes an anchor cable carrier and anchor cables 3; and when the hardening strength of the cement soil meets the tensioning and locking strength of a pressure type anchor, the maintenance period of the cements does not exceed 20 days.

[0039] The pressure-type anchor of the present invention refers to the pressure-type anchor defined in the Technical Specification for Ground Anchors (Cables) issued by the Standardization Institute of Chinese Construction enacted Technical specification.

[0040] The anchor cables 3 of the present invention can be steel strands, etc. The anchor cables 3 are provided with membranes. The anchor cables 3 provided with the membranes can be steel strands sheathed with plastic.

[0041] As shown in FIG. 5 and FIG. 6, the stepping speed of the drill rod of the cement-paste jet grouting cut-drilling segment 2 of a traditional jet spouting anchor is 20-40cm/min, and the length of the cement-paste jet grouting cut-drilling segment 2 is 8-12m; sometimes, jet spouting is executed one more time at a segment which is 0.5-1m away from the end of the cement-paste jet grouting cut-drilling segment 2; the inner diameter of the cross section of the cement-paste jet grouting cut-drilling segment 2 is 200-300mm, and the content of the cement mixed in the cement soil reserved in the cement-paste jet grouting cut-drilling segment 2 is 12%-18%. According to the present invention, the stepping speed of the drill rod of the cement-paste jet grouting cut-drilling segment 2 of the pressure-dispersion type bit expanded anchor is 4-8cm/min; the maximum inner diameter of the cross section of the cement-paste jet grouting cut-drilling segment 2 is 600-800mm; when the soil is clay, silty clay or floury soil, the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment reaches 30%-40%; and when the soil is sandy soil, and the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment reaches 15%-30%.

[0042] According to the construction method of the pressure-dispersion type bit expanded anchor in this embodiment, the anchor cable carriers are at least two carriers which are fixed in the hardened cement soil in the cement-paste jet grouting cut-drilling segment 2 at an interval along the length direction of the cement-paste jet grouting cut-drilling segment 2; the anchor cables 3 are anchor cables provided with membranes; the anchor cable carriers are hinge type

carriers or flat plate type carriers; when the anchor cable carriers are hinge type carriers, anchor cables 3 are coiled on the hinge type carriers in U-shape; and when the anchor cable carriers are flat plate type carriers, each flat plate type carrier is fixed with a fused anchor fixture for holding one end of an anchor cable 3. The anchor cable carriers may be two, three or more.

[0043] According to the construction method of the pressure-dispersion type bit expanded anchor in this embodiment, the drill rod brings the anchor cable carrier and the anchor cables 3 in when drilling.

[0044] According to the construction method of the pressure-dispersion type bit expanded anchor in this embodiment, the tensioning and locking strength of the pressure type anchor is greater than 2Mpa.

[0045] According to the construction method of the pressure-dispersion type bit expanded anchor in this embodiment, the inner diameter of the cross section of the water-pressure jet spouting cut-drilling segment 1 is 150-200mm.

[0046] According to the construction method of the pressure-dispersion type bit expanded anchor in this embodiment, the water pressure of the rotary water jet spouting cut-drilling is 2-15MPa; the cement paste pressure of the rotary cement paste jet spouting cut-drilling is 15-30MPa; and the water-cement ratio of the cement paste is 1.0-1.5.

[0047] According to the construction method of the pressure-dispersion type bit expanded anchor in this embodiment, when the drill rod ends the cut-drilling through cement-paste-pressure jet grouting and then exits after reaching the tail end of the cement-paste-pressure jet grouting cut-drilling segment 2, the cement-paste-pressure jet grouting cut-drilling segment 2 is supplemented with the cement paste at a low pressure; when the anchor has a waterproof curtain, the cement paste is grouted at a pressure of 0.5-2MPa at the junction of the waterproof curtain.

[0048] According to the construction method of the pressure-dispersion type bit expanded anchor in this embodiment, the length ratio of the cement-paste jet grouting cut-drilling segment 2 to the water-pressure jet grouting cut-drilling segment 1 is 0.06-0.3.

[0049] A structure of a pressure-dispersion type bit expanded anchor is provided in this embodiment, wherein the construction method of a pressure-dispersion type bit expanded anchor is adopted to respectively form a water-pressure jet grouting cut-drilling segment 1 and a cement-paste-pressure jet grouting cut-drilling segment 2 which communicate with each other from the inside to the outside; the cement paste in the rotary cement-paste-pressure jet grouting cut-drilling segment 2 gets hardened and encloses an anchor cable carrier and an anchor cable 3; the length of the cement-paste-pressure jet grouting cut-drilling segment 2 is controlled to be 2-4m; the maximum inner diameter of the cross section of the cement-paste-pressure jet grouting cut-drilling segment is 600-800mm; and the ratio of the inner diameters of the water-pressure jet grouting cut-drilling segment 1 and the cement-paste-pressure jet grouting cut-drilling segment 2 is within the range of 0.2-0.4.

[0050] When the soil is clay, silty clay or floury soil, the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment 2 is 30%-40%.

[0051] When the soil is sandy soil, the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment is 15%-30%.

[0052] The anchor cable carriers in this embodiment are at least two carriers which are fixed in the hardened cement soil in the cement-paste jet grouting cut-drilling segment 2 at an interval along the length direction of the cement-paste jet grouting cut-drilling segment 2; the anchor cables 3 are anchor cables provided with membranes; the anchor cable carriers are hinge type carriers or flat plate type carriers; when the anchor cable carriers are hinge type carriers, anchor cables 3 are coiled on the hinge type carriers in U-shape; and when the anchor cable carriers are flat plate type carriers, each flat plate type carrier is fixed with a fused anchor fixture for holding one end of an anchor cable 3. The anchor cable carriers may be two, three or more.

[0053] In this embodiment, the length ratio of the cement-paste jet grouting cut-drilling segment 2 to the water-pressure jet grouting cut-drilling segment 1 is 0.06-0.3.

[0054] In this embodiment, the cement used for making the cement paste is cement with a common strength rating or a high-mark cement with a strength rating of 52.5Mpa or above.

[0055] The construction method and the structure of the pressure-dispersion type bit expanded anchor rod in this embodiment are compared with those of the traditional jet spouting anchor, as shown in table 1:

Table 1

Characteristics	Pressure-dispersion type bit expanded anchor rod in this embodiment	Traditional jet spouting anchor
Steel strand	Not adhesive	Adhesive
Stressing mechanism	Pressure type	Tension type
Early cement strength	High	Low
Recyclable through core dismantling	Recyclable	Not recyclable

(continued)

Characteristics	Pressure-dispersion type bit expanded anchor rod in this embodiment	Traditional jet spouting anchor
Length of the water-pressure jet grouting cut-drilling segment	Long	Short
Displacement control performance	High	Low

[0056] It can be seen that, by the construction method and structure of the pressure-dispersion type bit expanded anchor in this embodiment, the cement-paste jet grouting cut-drilling segment 2 has a small length, a large diameter and a high cement content and is quick in cement hardening, directly improving the structure strength of the pressure-dispersion type bit expanded anchor and the early strength of the structure of the pressure-dispersion type bit expanded anchor, in particular improving the early anti-pulling capability of the cement-paste jet grouting cut-drilling segment 2. During actual engineering construction, the maintenance time for the cement soil strength of the cement-paste-pressure jet grouting cut-drilling segment to increase to the designed strength is reduced.

[0057] When the construction method and structure of the pressure-dispersion type bit expanded anchor in this embodiment are applied to the silty clay soil, the cement soil strength age of the silty clay increases. As shown in FIG. 7, by the structure of the pressure-dispersion type bit expanded anchor of the present invention, the strength of the cement soil can reach design requirements after 7-15 days, equivalent to the strength of the traditional jet spouting anchor after 28-50 days. Moreover, in the same maintenance age, the strength of the cement soil of the pressure-dispersion type bit expanded anchor of the present invention is far higher than the strength of the cement soil of the traditional jet spouting anchor.

[0058] The present invention is not limited to the above embodiment. For example: 1) Of course, when the construction method of the pressure-dispersion type bit expanded anchor in this embodiment adopts one anchor cable carrier, the anchor cable carrier is an anchor cable carrier fixed in the hardened cement soil in the cement-paste jet grouting cut-drilling segment 2; the anchor cables 3 are anchor cables provided with membranes; the anchor cable carriers are hinge type carriers or flat plate type carriers; when the anchor cable carriers are hinge type carriers, anchor cables 3 are coiled on the hinge type carriers in U-shape; and when the anchor cable carriers are flat plate type carriers, each flat plate type carrier is fixed with a fused anchor fixture for holding one end of an anchor cable 3. 2) According to the construction method of the pressure-dispersion type bit expanded anchor in this embodiment, after the drill rod ends the cut-drilling through cement paste jet spouting and exits, the anchor cable carrier and the anchor cables 3 are brought into the cement-paste jet grouting cut-drilling segment 2 in the non-jet-spouting state; a casing technology can be employed to bring the anchor cable carrier and the anchor cables 3 into the cement-paste jet grouting cut-drilling segment 2, or the drill rod can be used to bring the anchor cable carrier and the anchor cables 3 into the cement-paste jet grouting cut-drilling segment 2, etc. 3) The anchor cable carrier is an anchor cable carrier fixed in the hardened cement soil in the cement-paste jet grouting cut-drilling segment 2; the anchor cables 3 are anchor cables provided with membranes; the anchor cable carriers are hinge type carriers or flat plate type carriers; when the anchor cable carriers are hinge type carriers, anchor cables 3 are coiled on the hinge type carriers in U-shape; and when the anchor cable carriers are flat plate type carriers, each flat plate type carrier is fixed with a fused anchor fixture for holding one end of an anchor cable 3. Technical solutions made by equivalent substitution shall all fall within the protective scope of the claims of the present invention.

Claims

1. A construction method of a pressure-dispersion type bit expanded anchor, a drill rod performing cut-drilling through water-pressure jet grouting and cut-drilling through cement-paste-pressure jet grouting in soil in turn to respectively form a water-pressure jet grouting cut-drilling segment and a cement-paste-pressure jet grouting cut-drilling segment which communicate with each other from the inside to the outside, the drill rod ending the cut-drilling through cement-paste-pressure jet grouting and then exiting when reaching the tail end of the cement-paste-pressure jet grouting cut-drilling segment, **characterized in that**,

the cement-paste-pressure jet grouting type cut-drilling is one-time cut-drilling; when the one-time cut-drilling occurs, the drilling speed of the drill rod is controlled to be 4-8cm/min, and the length of the cement-paste-pressure jet grouting cut-drilling segment is controlled to be 2-4m, so that the maximum inner diameter of the cross section of the cement-paste-pressure jet grouting cut-drilling segment is 600-800mm; the ratio of the inner

diameters of the water-pressure jet grouting cut-drilling segment and the cement-paste-pressure jet grouting cut-drilling segment is within the range of 0.2-0.4;

when the soil is clay, silty clay or floury soil, the amount of the cement paste used is controlled to be 1.0-2 ton such that the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment reaches 30%-40%;

when the soil is sandy soil, the amount of the cement paste used is controlled to be 1-1.5 ton such that the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment reaches 15%-30%;

the cement soil in the cement-paste jet grouting cut-drilling segment gets hardened and fixes an anchor cable carrier and anchor cables; and when the hardening strength of the cement soil meets the tensioning and locking strength of a pressure type anchor, the maintenance period of the cements does not exceed 20 days.

2. The construction method of a pressure-dispersion type bit expanded anchor according to claim 1, wherein the anchor cable carriers are at least two carriers which are fixed in the hardened cement soil in the cement-paste jet grouting cut-drilling segment at an interval along the length direction of the cement-paste jet grouting cut-drilling segment; the anchor cables are anchor cables provided with membranes; the anchor cable carriers are hinge type carriers or flat plate type carriers; when the anchor cable carriers are hinge type carriers, anchor cables are coiled on the hinge type carriers in U-shape; and when the anchor cable carriers are flat plate type carriers, each flat plate type carrier is fixed with a fused anchor fixture for holding one end of an anchor cable.

3. The construction method of a pressure-dispersion type bit expanded anchor according to claim 1, wherein the anchor cable carriers is on anchor cable carrier which is fixed in the hardened cement soil in the cement-paste jet grouting cut-drilling segment; the anchor cables are anchor cables provided with membranes; the anchor cable carrier is a hinge type carrier or flat plate type carrier; when the anchor cable carrier is a hinge type carrier, the anchor cable is coiled on the hinge type carrier in U-shape; and when the anchor cable carrier is a flat plate type carrier, the flat plate type carrier is fixed with a fused anchor fixture for holding one end of an anchor cable.

4. The construction method of a pressure-dispersion type bit expanded anchor according to claim 1, 2 or 3, wherein the drill rod brings the anchor cable carrier and the anchor cable in when drilling.

5. The construction method of a pressure-dispersion type bit expanded anchor according to claim 1, 2 or 3, wherein after the drill rod ends the cut-drilling through cement-paste-pressure jet grouting and then exits, the anchor cable carrier and the anchor cables are brought in the cement-paste jet grouting cut-drilling segment in the non-jet-spouting state.

6. The construction method of a pressure-dispersion type bit expanded anchor according to claim 1, 2 or 3, wherein the water pressure of the rotary water jet spouting cut-drilling is 2-15MPa; the cement paste pressure of the rotary cement paste jet spouting cut-drilling is 15-30MPa; and the water-cement ratio of the cement paste is 1.0-1.5.

7. The construction method of a pressure-dispersion type bit expanded anchor according to claim 1, 2 or 3, wherein when the drill rod ends the cut-drilling through cement-paste-pressure jet grouting and then exits after reaching the tail end of the cement-paste-pressure jet grouting cut-drilling segment, the cement-paste-pressure jet grouting cut-drilling segment is supplemented with the cement paste at a low pressure; when the anchor has a waterproof curtain, the cement paste is grouted at a pressure of 0.5-2MPa at the junction of the waterproof curtain.

8. The construction method of a pressure-dispersion type bit expanded anchor according to claim 1, 2 or 3, wherein the length ratio of the cement-paste jet grouting cut-drilling segment to the water-pressure jet grouting cut-drilling segment is 0.06-0.3.

9. The construction method of a pressure-dispersion type bit expanded anchor according to claim 1, 2 or 3, wherein the cement used for making the cement paste is cement with a common strength rating or a high-mark cement with a strength rating of 52.5Mpa or above.

10. A structure of a pressure-dispersion type bit expanded anchor according to claim 1, the construction method of a pressure-dispersion type bit expanded anchor being adopted to respectively form a water-pressure jet grouting cut-drilling segment and a cement-paste-pressure jet grouting cut-drilling segment which communicate with each other from the inside to the outside, the cement paste in the rotary cement-paste-pressure jet grouting cut-drilling segment getting hardened and enclosing an anchor cable carrier and an anchor cable, **characterized in that**, the length of

the cement-paste-pressure jet grouting cut-drilling segment is controlled to be 2-4m; the maximum inner diameter of the cross section of the cement-paste-pressure jet grouting cut-drilling segment is 600-800mm; the ratio of the inner diameters of the water-pressure jet grouting cut-drilling segment and the cement-paste-pressure jet grouting cut-drilling segment is within the range of 0.2-0.4;

when the soil is clay, silty clay or floury soil, the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment is 30%-40%;

when the soil is sandy soil, the content of the cement mixed in the cement soil reserved in the cement-paste-pressure jet grouting cut-drilling segment is 15%-30%.

11. The structure of a pressure-dispersion type bit expanded anchor according to claim 10, wherein the anchor cable carriers are at least two carriers which are fixed in the hardened cement soil in the cement-paste jet grouting cut-drilling segment at an interval along the length direction of the cement-paste jet grouting cut-drilling segment; the anchor cables are anchor cables provided with membranes; the anchor cable carriers are hinge type carriers or flat plate type carriers; when the anchor cable carriers are hinge type carriers, anchor cables are coiled on the hinge type carriers in U-shape; and when the anchor cable carriers are flat plate type carriers, each flat plate type carrier is fixed with a fused anchor fixture for holding one end of an anchor cable.

12. The structure a pressure-dispersion type bit expanded anchor according to claim 10, wherein the anchor cable carriers is on anchor cable carrier which is fixed in the hardened cement soil in the cement-paste jet grouting cut-drilling segment; the anchor cables are anchor cables provided with membranes; the anchor cable carrier is a hinge type carrier or flat plate type carrier; when the anchor cable carrier is a hinge type carrier, the anchor cable is coiled on the hinge type carrier in U-shape; and when the anchor cable carrier is a flat plate type carrier, the flat plate type carrier is fixed with a fused anchor fixture for holding one end of an anchor cable.

13. The structure a pressure-dispersion type bit expanded anchor according to claim 10, 11 or 12, wherein the length ratio of the cement-paste jet grouting cut-drilling segment to the water-pressure jet grouting cut-drilling segment is 0.06-0.3.

14. The structure a pressure-dispersion type bit expanded anchor according to claim 10, 11 or 12, wherein the cement used for making the cement paste is cement with a common strength rating or a high-mark cement with a strength rating of 52.5Mpa or above.

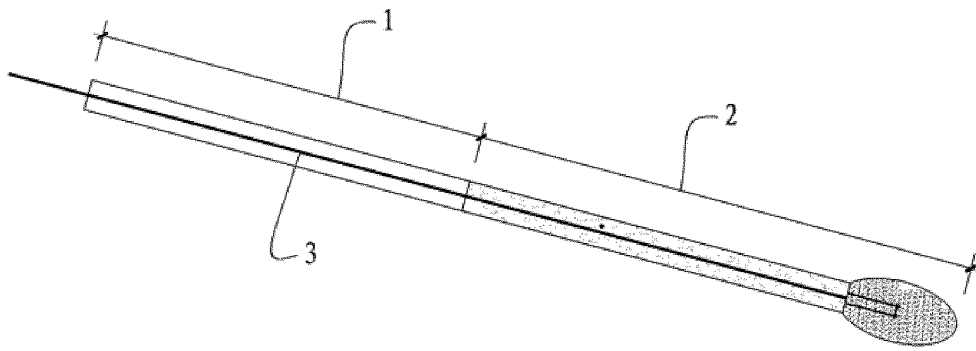


FIG. 1

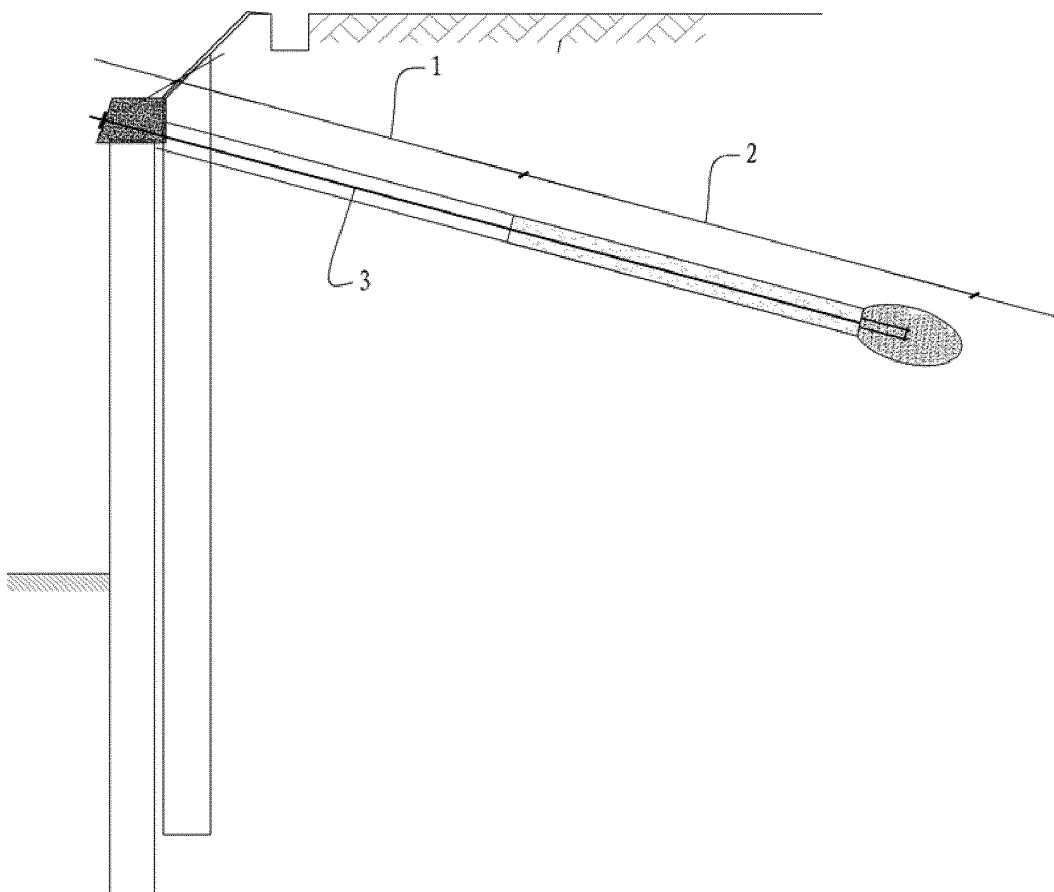


FIG. 2

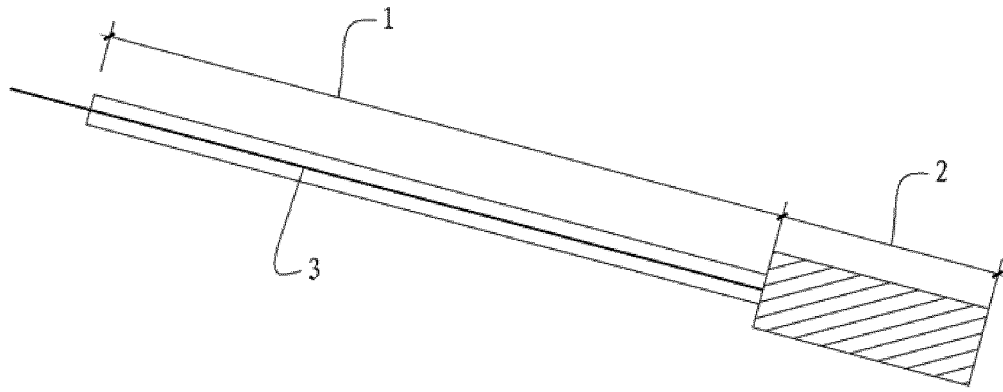


FIG. 3

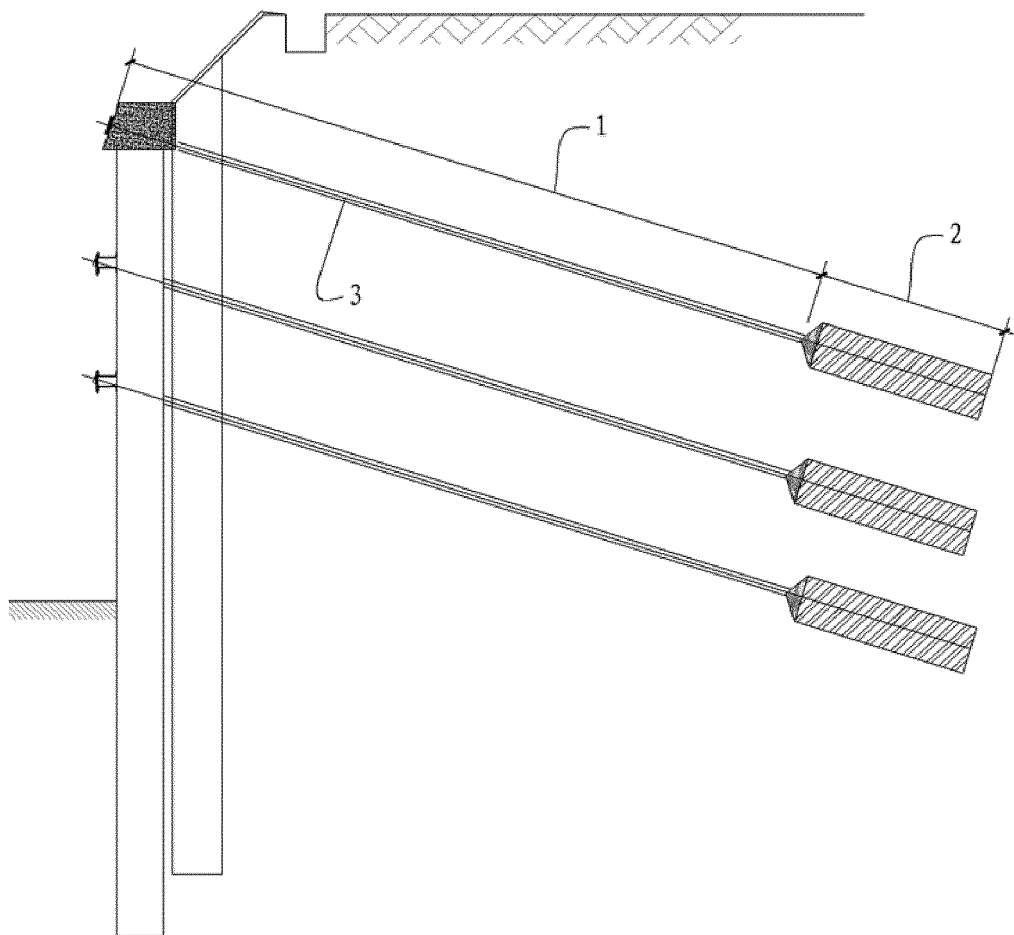


FIG. 4

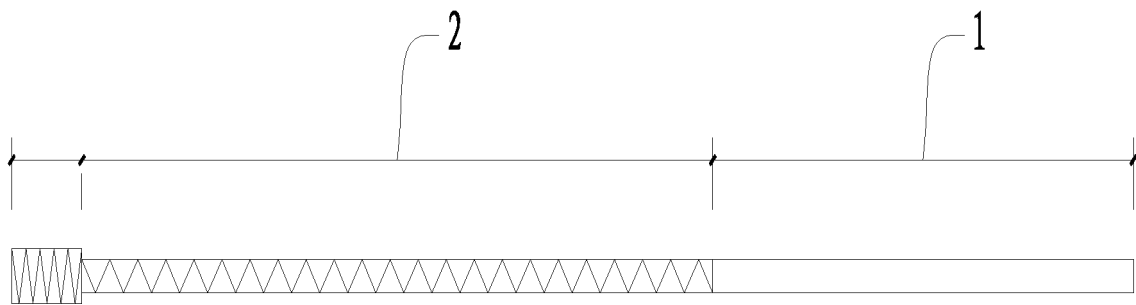


FIG. 5

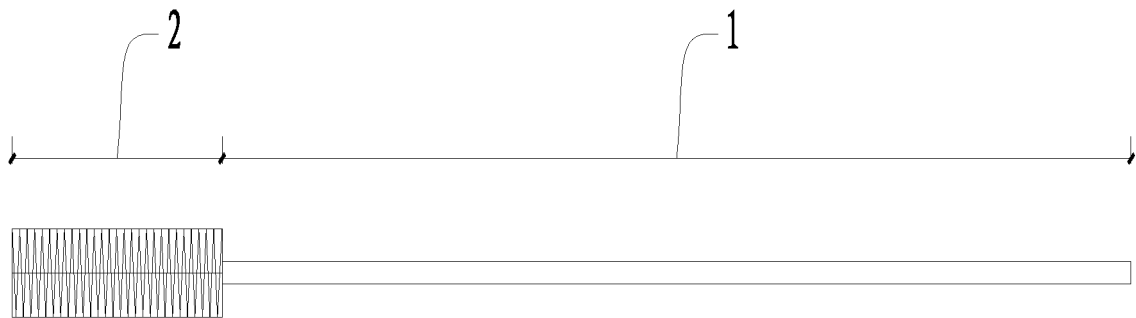


FIG. 6

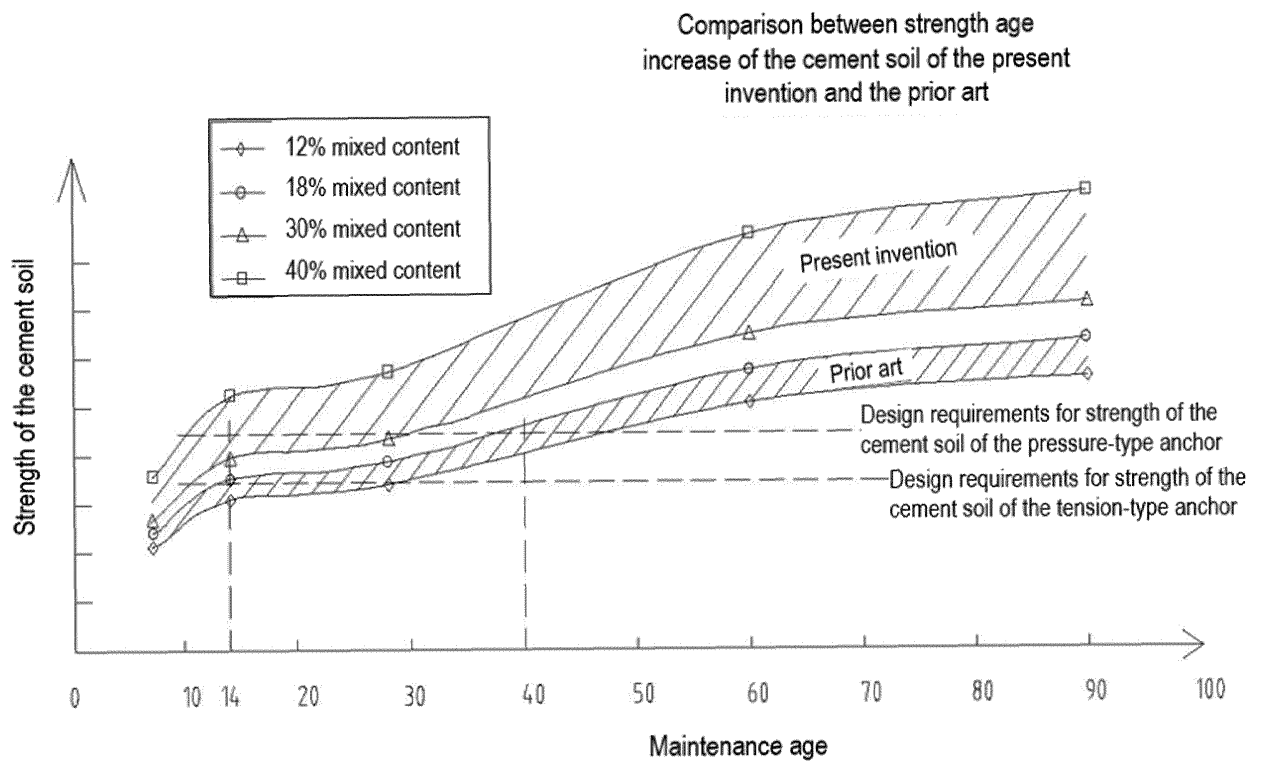


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2015/078695

A. CLASSIFICATION OF SUBJECT MATTER

E02D 5/74 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E02D 5

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CPRSABS; VEN; CNKI: anchor cable, anchor stock, anchor pile, spinning jetting, bit expansion, pressure type, speed, revolution, tie, spout, gyrate, bolt, stock, arm, head, pression, compression, drilling, sparging, force, spray, enlarge, traverse, anchor, eject+, spurt, inject+, boring, big, pressure, jetting, rod, expanding

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 104032737 A (SUZHOU NG. FOUNDATION ENGINEERING CO., LTD.), 10 September 2014 (10.09.2014), claims 1-12, description, paragraphs [0046]-[0072], and figures 3-4	1-14
PX	CN 203866824 U (SUZHOU NG. FOUNDATION ENGINEERING CO., LTD.), 08 October 2014 (08.10.2014), description, paragraphs [0033]-[0058], and figures 3-4	1-14
A	CN 101575854 A (SHANXI ZHONGJI GEOTECHNICAL ENGINEERING CO., LTD.), 11 November 2009 (11.11.2009), claims 1-2, description, the part of particular embodiments, and figures 1-8	1-14
A	CN 103526754 A (CHINA CONSTRUCTION EIGHTH ENGINEERING DIVISION. CORP. LTD.), 22 January 2014 (22.01.2014), the whole document	1-14
A	JP 2000345560 A (UTSUNOMIYA, H.), 12 December 2000 (12.12.2000), the whole document	1-14
A	DE 3824955 A1 (GKN KELLER GMBH), 25 January 1990 (25.01.1990), the whole document	1-14

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search 02 July 2015 (02.07.2015)	Date of mailing of the international search report 17 July 2015 (17.07.2015)
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer YAN, Junxia Telephone No.: (86-10) 62084950

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2015/078695

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CN 103526754 A	22 January 2014	None	
JP 2000345560 A	12 December 2000	None	
DE 3824955 A1	25 January 1990	None	

Form PCT/ISA/210 (patent family annex) (July 2009)