Oct. 22, 1963 A. BRANDESTINI 3,107,983

METHOD OF ANCHORING WIRE BUNDLES FOR PRESTRESSED CONCRETE CONSTRUCTIONS

Filed July 1, 1959 3 Sheets-Sheet 1

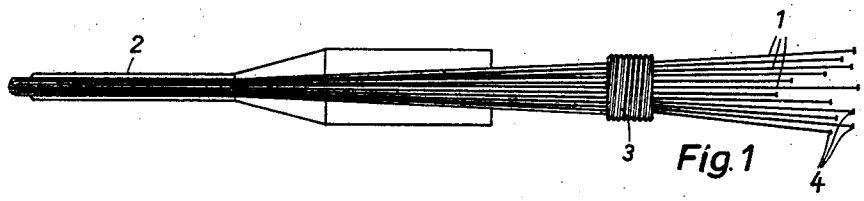


Fig. 1

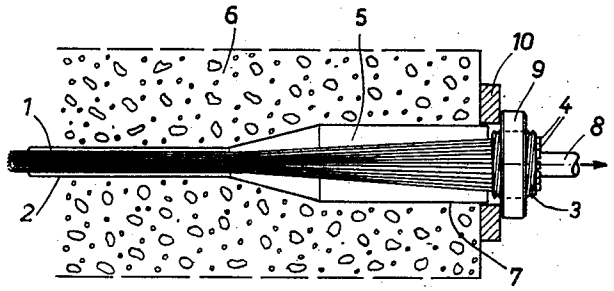


Fig. 2

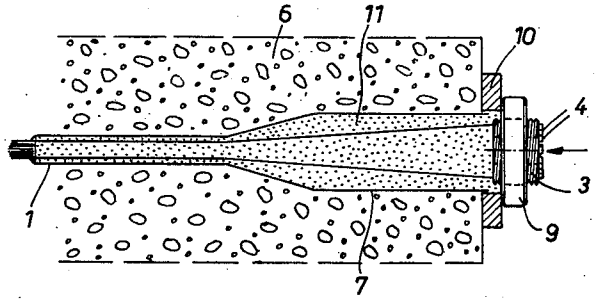


Fig. 3

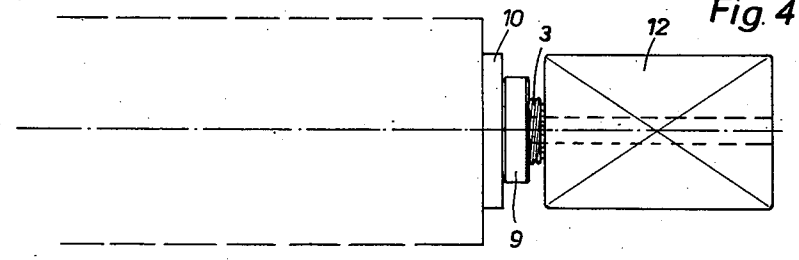


Fig. 4

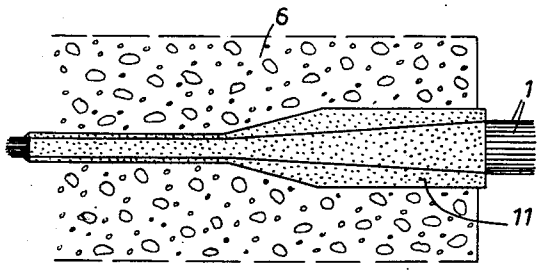


Fig. 5

INVENTOR

ANTONIO BRANDESTINI

By

Wenderoth, Lind & Ponack

Attys.

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METHOD OF ANCHORING WIRE BUNDLES FOR PRESTRESSED CONCRETE CONSTRUCTIONS

Filed July 1, 1959 3 Sheets-Sheet 2

Fig. 6

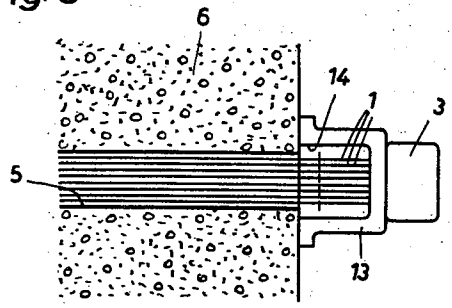


Fig. 7

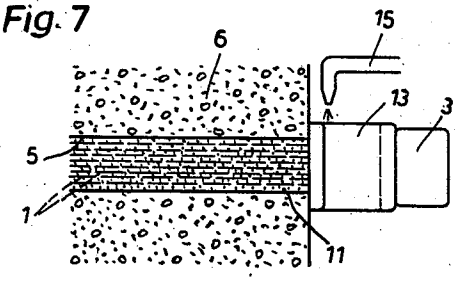
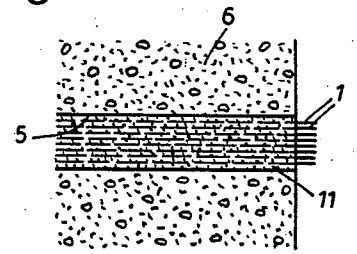


Fig. 8



INVENTOR

ANTONIO BRANDESTINI

By

Wenderoth, Lind + Ponack

Attys.

Oct. 22, 1963 A. BRANDESTINI 3,107,983

METHOD OF ANCHORING WIRE BUNDLES FOR PRESTRESSED CONCRETE CONSTRUCTIONS

Filed July 1, 1959 3 Sheets-Sheet 3

Fig. 9

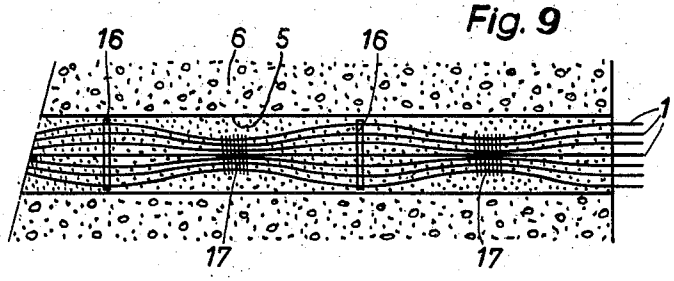


Fig. 10

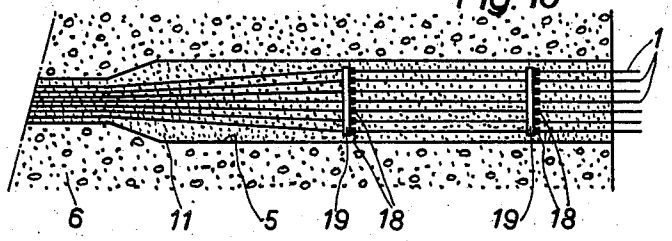


Fig. 11

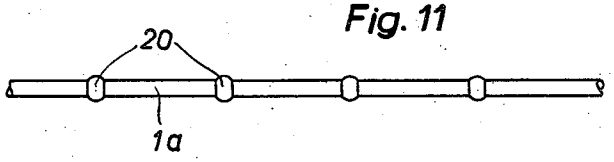


Fig. 12



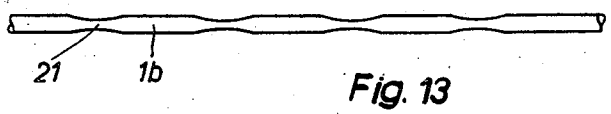


Fig. 13

Fig. 14



INVENTOR
ANTONIO BRANDESTINI

By
Wenderoth, Lind & Ponack
Attys.

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METHOD OF ANCHORING WIRE BUNDLES FOR PRESTRESSED CONCRETE CONSTRUCTIONS

Antonio Brandestini, 8 Oberdorfstrasse,
Zurich, Switzerland

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Claims priority, application Switzerland July 5, 1958
1 Claim. (Cl. 25—154)

The present invention relates to a method of anchoring wire bundles for prestressed concrete constructions by means of anchor bodies engaging the ends of each bundle.

Today quite a number of methods are known, in which entire wire bundles are prestressed and subsequently secured at their ends in anchor bodies bearing against the concrete construction. The wire bundles usually consist of parallel, high-quality steel wires having a diameter from 5 to 8 mm. and a circular or oval cross-section. The anchoring of the individual wires in the anchor bodies is brought about either by wedging action or by upsetting the wire ends. All these methods have the disadvantage that relatively expensive anchor bodies must be used, which remain in the construction and increase the costs thereof. In order to reduce these anchoring costs, anchors have been already proposed, which have comparatively small dimensions. After the wire bundle has been prestressed, these small anchors are housed in a recess of the construction, whereupon mortar is pressed into the recess and in turn is encircled by a surrounding wire spiral. After the pressure-inserted mortar has hardened, the anchor bodies are supported by the hardened mortar. Such a solution has been disclosed for the first time in FIG. 7 of the Swiss Patent No. 279,562. The mortar pressed into the recess serves as bearing surface for the anchor bodies, which also in this case remain within the construction.

It is an object of the present invention to provide a more economical method of producing prestressed concrete.

The method according to the invention consists in that the ends of the wires of the wire bundle, situated in a terminal recess of the concrete, are first anchored on the associated anchor body, whereupon the wire bundle is prestressed and mortar is forced into the recess at the rear of the anchor body, and then the anchor body is removed after the mortar enclosing the wires has hardened, so that the wires of the bundle are anchored solely by adhering to the hardened mortar.

It has been already general practice in the so-called prestressed bedding technique, known in wire bundle anchorings for prestressed concrete constructions, to directly anchor, solely by adhesion of the concrete of the building construction, particularly wires having a comparatively small diameter and especially profiled or flat wires, without the use of end anchors. This tension bedding method, however, has considerable disadvantages in comparison with the method according to the invention, in which no tension bedding is used. The tension bedding method thus requires long tension tracks, at the ends of which the individsal prestressed bundles must be secured prior to the introduction of the concrete. In the method according to the invention such tension tracks are not required, since the prestressing force is directly transmitted to the hardened concrete construction.

The method according to the invention may include the additional provision of severing the wire ends behind the anchor body, after the mortar enclosing the wires has been hardened, to facilitate the removal of the anchor body.

The present method may also include the supplemental steps, for the purpose of increasing the adhesive ability,

that prior to the tensioning of the wire bundle, at least the wire bundle section located in the terminal recess of the concrete construction is provided with obstructing means in such manner that longitudinally spaced portions of this bundle section have a cross-section differing from the adjacent bundle cross-sections.

The present invention will now be described more fully with reference to the accompanying drawings illustrating, by way of example, several embodiments of the invention, and in which:

FIGURE 1 is the end of a wire bundle having an anchoring body associated therewith,

FIGURE 2 shows the end of a wire bundle resting against the concrete construction by means of the anchor body,

FIGURE 3 shows the wire bundle end after the mortar has been pressed in,

FIGURE 4 indicates the wire bundle end together with a device for the removal of the small heads of the wires,

FIGURE 5 is the end of the wire bundle anchored by adhesion after removal of the anchor body,

FIGURE 6 shows the end of a wire bundle after said bundle has been prestressed,

FIGURE 7 shows the wire bundle end after the injected mortar has been hardened and prior to the removal of the anchor body,

FIGURE 8 is the completed anchoring of the wire bundle after the anchor body has been removed,

FIGURE 9 is an example of a wire bundle end anchored by the adhesive action of the hardened mortar,

FIGURE 10 illustrates a further example of a wire bundle end firmly anchored by adhesion, and

FIGURES 11 to 14 show each an example of a bundle wire.

In the example shown in FIGURES 1 to 5, the wire bundle consists of a plurality of high-quality steel wires 1, which are enclosed by a tubular casing 2. The wire ends are passed through cylindrical holes of a cylindrical externally threaded anchor body 3 which has a threaded, central bore (FIGURE 1). Then, small anchoring heads 4 are produced on the ends of the wires by a cold upsetting operation. The wire bundle, thus encased and provided with the anchor body 3, is subsequently placed in known manner into the casing or boarding of the concrete construction, whereupon concrete is filled in. During this concreting operation, the wire bundle end carrying the anchor body 3 is situated within a recess 5, which is formed by an enlarged end portion 7 of the tubular casing 2 located at the end of the built construction 6. The wire bundle is now tensioned by means of a suitable, e.g. hydraulic or pneumatic traction device not shown acting on a spindle 8 which is screwed into the central threaded bore of the anchor body 3. The small anchor heads 4 then will abut against the outer frontal surface of the anchor body 3, which in turn is pulled out of the recess 5. The anchor body 3 is supported upon the front face of the hardened concrete construction 6 by means of a nut 9 screwed on the anchor body 3 and a washer 10 (FIGURE 2). After removal of the tensioning device mortar 11 is forced into the recess 5 through the central bore of the anchor body 3. The mortar 11 encloses the end portion of the wire bundle in close contact with the wires. After the mortar has hardened, the wires 1 firmly adhere to the mortar (FIGURE 3). Since the diameter of the anchor body 3 for the reception of a plurality of wires 1 must necessarily be larger than the diameter of the bundle lying within the tubular casing 2, the wire ends diverge within the recess, i.e. the wire ends leaving the tubular casing 2 spread apart towards the anchor body 3 to a bundle diameter, which is greater in comparison with the internal diameter of the tubular casing, so that

these wire ends will be accessible from all sides for the mortar 11 forced into the recess 5. Thereby a perfect adhesion of the wires to the mortar is obtained. A device 12, which may be e.g. a grinding or milling device, is now placed against the anchor 3 and operated to remove the small anchor heads 4 on the ends of the wires (FIGURE 4). The anchor body 3 together with nut 9 and washer 10 can now be taken away, so that none of the original anchoring elements remains in or on the concrete construction (FIGURE 5).

The removal of the small anchor heads may also be effected by only partly grinding off the latter and subsequently extracting the anchor body under corresponding deformation of the remaining portion of the small anchor head.

In case a dismountable anchor body is used, the small anchor heads on the wires have not to be removed. In this case a lowerable abutting device is arranged in place of the washer 10; after the mortar has hardened this device will be lowered, whereafter the nut 9 is removed and the anchor body, by disassembling the latter, is taken off.

The wire bundle can also be anchored in a common anchor body by means of a wedge and secured to the concrete construction after tensioning by means of a lowering device. After hardening of the mortar the lowering device is moved downwards, the wedge thus relieved is removed and the anchor body can be withdrawn.

The method according to the invention also permits the use of curved wire bundles, which fact in many cases represents a static advantage. The casing for the concrete construction according to the described method can be removed again rapidly, i.e. prior to the prestressing of the concrete; it thus may be used several times. The production of a plurality of similar constructions, e.g. several similar beams or girders, requires only the provision of a single casing. The described method can be applied for the production of prestressed concrete girders directly on the building-site, since no larger installations, such as for example a tensioning bed, are required.

In the embodiment shown in FIGURES 6 to 8, the wire bundle consists of a plurality of high-grade steel wires 1, which are enclosed by a sheathing not shown. The wire ends are secured to an anchor body 3 in a manner known per se passing them for instance through cylindrical holes of the anchor body and providing them with upset small anchor heads, which abut against the anchor body, when the bundle is subjected to tension. The bundle provided with the sheathing and the anchor body is then placed in the casing for the concrete construction, whereupon the concrete work is effected. After the bundle has been prestressed, during which operation the anchor body is pulled away from the concrete construction 6 and the wire end portions protrude out of an end recess 5 present in the concrete construction, the anchor body is temporarily supported on the hardened concrete structure 6 by means of a supporting bracket 13, which through the intermediary of a lateral aperture 14 affords free access, at least from one side, to the wire portions situated between anchor body 3 and concrete construction 6. Thereafter, mortar 11 is forced into the recess 5, which mortar closely surrounds the wire portions contained therein. After the mortar 11 has been hardened, the wires 1 contacting said mortar firmly, adhere to the latter (FIGURE 7) and the anchor body 3 can now be removed. For this purpose the wire ends behind the anchor body 3 are severed by means of a cutting torch 15 passed through the lateral aperture 14 of the supporting bracket 13. When no free wire ends shall project from the completed concrete structure (not as shown in FIGURE 8), then the cut of the burner naturally may be guided immediately along the front surface of the concrete construction 6, so that the wire ends are cut off flush with that surface.

In place of a cutting torch 15, any other cutting or grinding tool may also be employed for severing the wire end portions anchored on the anchor body 3.

The losses of wire material entailed through severing the wire ends are very low, while the cutting operation can be carried out rapidly and a clean cut is obtained without requiring any complicated equipment.

In order to insure a perfect bedding of the wire portions, located in the recess 5 of the concrete structure 6, within the pressure-inserted mortar, these wire end portions can be slightly spread apart from each other starting at the tubular sheath. On the other hand, the bundle portion housed in the recess 5 may be provided with obstructions in order to improve adhesion; thus wire strands, profiled or upset wires may be used, or this bundle portion may be twisted, or spread several times in spaced intervals and again combined.

In the example shown in FIGURE 9 the wire bundle consists of a plurality of high-grade steel wires 1 which are surrounded by a tubular sheath, not shown. After the wire ends have been secured to an anchor body and placed into the casing for the concrete construction in a manner known per se, it is concreted, a recess 5 being produced in the zone of the wire bundle ends by an enlarged end portion of the tubular casing. The wire bundle section, which will be placed into this recess after the bundle has been prestressed, is provided with obstructing means, improving the adhesion of this bundle section, prior to the insertion of the bundle into the casing and prior to the application of the anchor. In the embodiment according to FIGURE 9, for the provision of the said obstructing means longitudinally spaced perforated plates 16 are provided, having holes spaced apart from each other a relatively great distance, through which holes the wires are passed and thus are spread apart with respect to the wires in the bundle situated in the tubular sheath, while the bundle section located between two adjacent perforated plates 16 is again constricted by a suitable lacing 17. The perforated plates 16 may consist of sheet metal. By means of the described repeated spreading and contricting of the bundle, the cross-section thereof is changed several times within the recess 5, whereby the adhesion is considerably improved in comparison with the parallel-wired bundle, having the same cross-section throughout its extent.

In the embodiment of the invention shown in FIGURE 10 the obstructing means, which cause a variation in cross-section of the bundle length situated in the terminal recess 5 of the concrete structure 6, are formed by small upset heads 18 and auxiliary anchor plates 19. Before the bundle is brought into the casing for the concrete structure the end portions of the wires protruding out of the tubular sheath are passed through perforations of a first auxiliary anchor plate 19, whereby the bundle is spread, due to the relatively wide spacing of the perforations in the plate, with respect to the bundle cross-section in the tubular sheath, whereupon small heads 18 are upset on the wires 1; in the described example the end portions of the wires are subsequently forced through the holes of a second auxiliary anchor plate 19, which is spaced some distance apart from the first plate 19, and provided with additional small upset heads 18 in front of this plate. Naturally, more than two auxiliary anchor plates 19 could also be arranged. The auxiliary anchor plates can be formed by relatively thin sheet metal. Also in this case, the anchor plates 19 cooperating with the small heads 18 form obstructing means, by which the bundle cross-section at these points is so modified with respect to the adjacent cross-sections, that a considerable improvement of the adhesive power of the wire bundle in the concrete 11 will be obtained.

Obstructions, causing a sectional variation of the bundle lying in the terminal recess 5, can also be produced by twisting or interlacing this bundle portion. Moreover, the individual wires of the bundle themselves may be

provided with such obstructing and retaining means. Examples of such wires are illustrated in FIGURES 11 to 14. As shown in FIGURE 11, the wire 1*a* is provided with closely spaced upset portions 20. The wire 1*b* according to FIGURES 12 and 13 includes compressed flattened portions 21 for the same purpose. Finally, FIGURE 14 shows a wire 1*c* formed as stranded unit.

After the necessary retaining and bonding expedients have been provided on the wire bundles in the manner described, either through supplementary application of auxiliary elements, through deforming operations, or by means of suitable selection of profiled wires, and after the ends of the bundle have been fitted with an anchor body, the bundle is placed into the casing for the concrete structure and prestressed after concreting. The anchor body, not shown, which serves for the provisional support of the tensioned bundle on the concrete construction is removed after the mortar forced into the terminal recess 5 has hardened, so that the bundle remains anchored in stressed condition exclusively by adhering to the pressure-inserted mortar. The removal of the anchor body can be brought about by severing the wires immediately behind the anchor body, e.g. by means of a cutting burner or a grinding disk. When the wires are secured to the anchor body by means of small upset heads, then for removing the anchor body only the small anchoring heads may be ground away or, after preliminary grinding, broken off.

I claim:

A method of anchoring wire bundles for prestressing concrete structures, by means of anchor bodies each engaging the wire ends of one bundle situated in a terminal recess of the concrete structure, comprising the steps of temporarily anchoring the wire ends of the bundle of wires on the associated anchor body provided with a plurality of cylindrical perforations, by passing each wire of the bundle through one perforation of the anchor body and then forming a head at each wire end by a cold upsetting operation, prestressing the wire bundle while having said heads abut against one face of the anchor body, forcing mortar into said terminal recess at the rear of the anchor body, removing said heads on the wire ends when the mortar in said recess has set, and taking off the anchor body from the wire ends, whereby the wires of the bundle are anchored solely by adhering to the hardened mortar in said recess, said heads on the wire ends being at least partly removed by a grinding operation when the mortar has set in said terminal recess, and then the anchor body is pulled off from the wire ends by deforming the remaining portions of the heads.

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