

Nov. 22, 1966

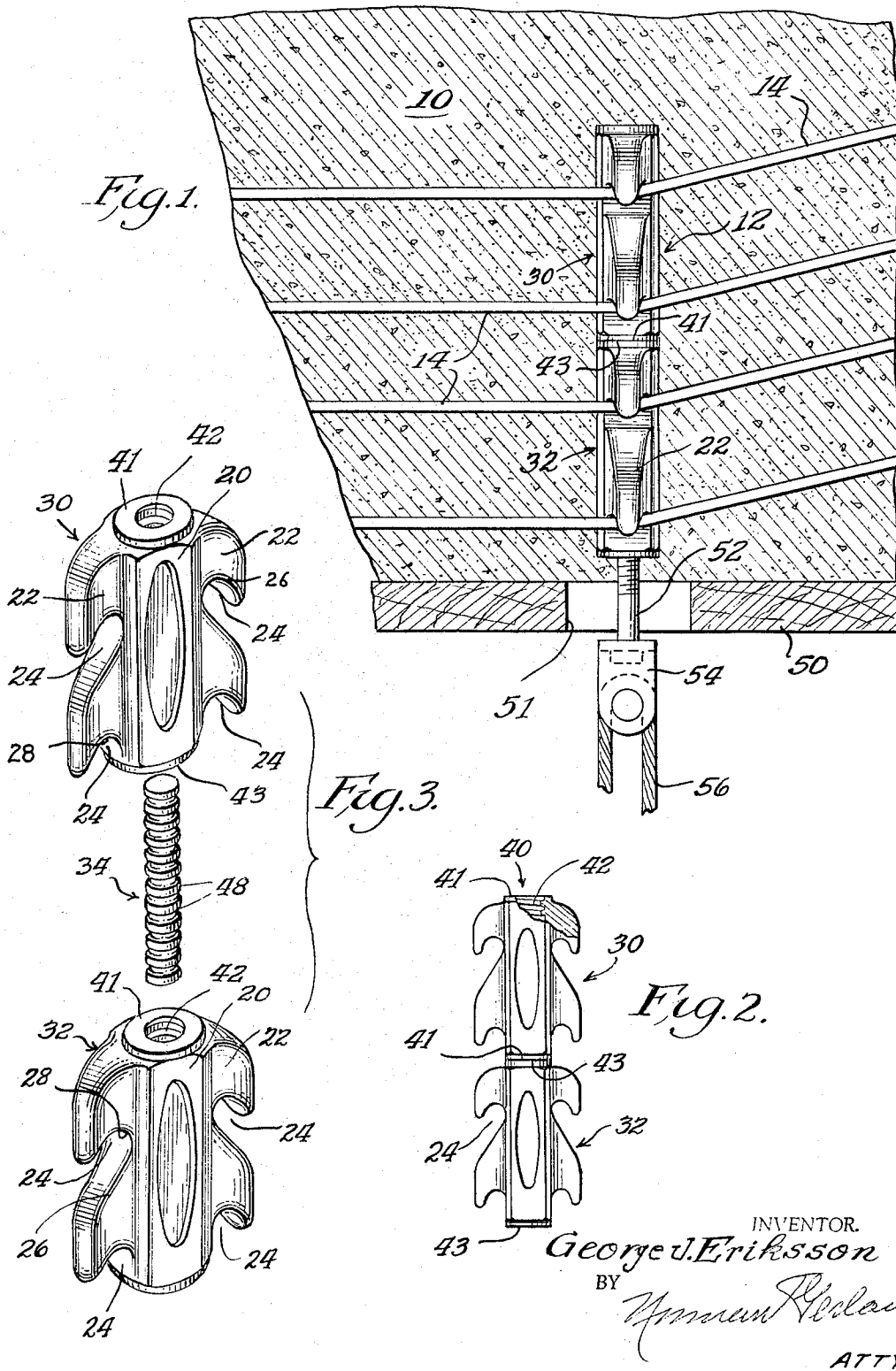
G. J. ERIKSSON

3,286,419

SECTIONAL HOLD-DOWN ANCHOR DEVICE

Filed Dec. 26, 1963

2 Sheets-Sheet 1



1

3,286,419

SECTIONAL HOLD-DOWN ANCHOR DEVICE
George J. Eriksson, Morton Grove, Ill., assignor to
Superior Concrete Accessories, Inc., Franklin Park,
Ill., a corporation of Delaware
Filed Dec. 26, 1963, Ser. No. 333,409
4 Claims. (Cl. 52—225)

The present invention relates generally to hold-down anchor devices by means of which the tensioning cables which are embedded in a prestressed concrete beam may be held under tension and in their proper relative positions within the beam form during initial pouring and subsequent hardening or setting of the beam-forming concrete so that when the tension in the cables is relieved, after the concrete has become set and the projecting ends of the cable severed from the ends of the beam, the concrete of the beam will remain prestressed, thus causing the beam to possess greater strength than conventional beams which are not prestressed in this manner.

It is well known that a more favorable distribution of stresses within a prestressed beam can be obtained if portions of the prestressing cables are deflected. For example, in connection with a prestressed concrete I-beam, certain of the cables are strung through the concrete form so that they will extend inwardly from the ends of the beams in the head portion thereof and will be inclined downwardly and pass through the narrow web portion of the beam and enter the base portion, after which they will extend longitudinally in straight-line fashion through the base portion of the beam. The cables are thus caused to make a "dip" as they pass through the beam from one end to the other. To hold the cables thus deflected, cable-restraining devices which are commonly referred to as hold-down anchor devices are provided at the points where cable deflection takes place. According to one method of tensioning the cables within a concrete beam form, hold-down anchor devices are positioned at the points where deflection of the cables is desired. The cables are then passed beneath the anchor devices and, thereafter, tension is applied to the cables to draw them taut. When this method of tensioning the cables is resorted to, the hold-down anchor devices usually are provided with anti-friction means such as rollers or polished smooth surfaces under which the cables may slide easily during cable-tensioning operations. Another method of tensioning such cables involves a partial tensioning of the cables in their "up" positions, after which final tensioning is achieved by deflecting the cables downwardly at the points of deflection. This is accomplished by the use of hold-down anchor devices which are caused to engage the cables, after which the devices are forced bodily downwardly by a pull-down or a push-down operation so as to carry the cables with them, thus effecting the desired cable deflection and tensioning. It is to this latter type of hold-down anchor device that the present invention specifically relates.

According to the present invention, there is provided an improved hold-down anchor device which is of a sectional nature and consists of two or more identical castings, together with connecting means whereby the various sections or castings may be assembled upon one another. A single casting will restrain and accommodate two or four cables. Two or more castings may be used as an assembly to restrain and accommodate six or more cables.

The provision of a sectional hold-down anchor device of the pull-down type such as has briefly been outlined above being among the principal objects of the invention, a further object is to provide such a device wherein, regardless of the number of castings that may be used or

2

employed for any given pull-down operation, uniform cable spacing will result.

Another object of the invention is to provide a sectional hold-down anchor device having novel means whereby adjacent castings may be secured together in their operative assembled relationship, such means comprising a connector part in the form of a short rod section which, itself, may be in the form of a casting or may be a machined part, the rod section being formed with male contour or cut threads which mate with cooperating female contour threads on the adjacent anchor device castings which are to be joined together. By such an arrangement, any given anchor device assembly will be formed entirely of main body castings and at least one connector casting, the number of connector castings being one less in each instance than the number of main body castings.

A further object of the invention is to provide a sectional hold-down anchor device assembly having associated therewith novel means whereby the extent of threaded engagement between the anchor device body castings and the connector part is limited, to the end that, upon assembly of the various castings which cooperate to make up a given composite hold-down anchor device, each connector part will have approximately equal, and in any event, adequate threaded engagement with the adjacent body castings.

The provision of a composite sectional hold-down anchor device of the pull-down type which, despite its sectional nature, will withstand comparatively heavy stresses; one in which such stresses are applied entirely to the main body castings exclusive of the connector parts; one in which the component parts thereof may be assembled in the field to make up a composite hold-down anchor device having the desired numerical cable capacity; one which requires for its assembly no tools whatsoever nor the use of more than mere manual force; one which lends itself to conventional pull-down operations utilizing conventional pull-down apparatus; and one which, otherwise, is well-adapted to perform the services required of it, are further desirable features which have been borne in mind in the production and development of the present invention.

In the accompanying two sheets of drawings forming a part of this specification, one illustrative embodiment of the invention has been shown.

In these drawings:

FIG. 1 is a fragmentary vertical sectional view taken substantially centrally and longitudinally through a limited longitudinal section of a concrete beam form showing in operative position in the form one of the improved sectional hold-down anchor devices embodying the present invention;

FIG. 2 is a front elevational view of the anchor device of FIG. 1;

FIG. 3 is an exploded perspective view of a three-piece sectional hold-down anchor device including two body castings and one connector part;

FIG. 4 is a side elevational view of one of the body castings;

FIG. 5 is a top plan view of the body casing of FIG. 4;

FIG. 6 is a bottom plan view of the body casting of FIGS. 4 and 5;

FIG. 7 is a vertical sectional view taken along the line 7—7 of FIG. 3;

FIG. 8 is a side elevational view, partly in section and schematic in its representation, illustrating one of several methods which may be employed for applying final tensioning stress to the cables associated with a concrete beam form during installation of one of the improved hold-down anchor devices in the form; and

FIG. 9 is a sectional view similar to FIG. 7 but show-

ing a modified form of body casting capable of use in connection with the present invention.

Referring now to the drawings in detail and in particular to FIG. 1, a fragmentary portion of a prestressed concrete beam has been illustrated and designated in its entirety by the reference numeral 10. The fragment of the beam which is shown in this view is a fragment which contains one of the sectional hold-down anchor devices 12 of the present invention, the device accommodating eight tensioning cables 14 and being disposed at a longitudinal region of cable-deflection within the beam. The beam 10 is shown in FIG. 1 as being disposed within a concrete beam form which is initially prepared to receive the concrete for the beam during pouring operations and such form is shown in the condition which it assumes after the concrete has hardened and before the form has been dismantled and removed from the finished beam. The beam 10 may be assumed to be a prestressed concrete I-beam and the section represented by FIG. 1 is taken longitudinally through the web and base portions of the beam. For a full disclosure of a prestressed concrete beam having the configuration of an I-beam and utilizing hold-down anchor devices in the web portion thereof, reference may be had to United States Patent No. 3,006,114, granted on October 31, 1961, and entitled, "Hold-Down Anchor Device for the Embedded Cables of Prestressed Concrete Girders."

While any number of cables 14 may be employed, depending upon the height of the beam 10, the group of cables illustrated in FIG. 1 consists of eight cables, such cables being arranged in two vertical tiers of four cables each. Additional groups of similarly arranged cables may be disposed on either side or both sides of the cables that are illustrated herein, in which case, each group of eight cables will be accommodated by one of the hold-down anchor devices 12. It will be understood that a similar arrangement of prestressing cables may be employed in connection with elongated beams other than those which are specifically of I-beam configuration. The specific nature or cross-sectional shape of the prestressed concrete beam 10 forms no part of the present invention and no claim is made herein to any novelty associated therewith, the novelty of the present invention residing rather in the construction of the various composite or sectional hold-down anchor devices 12 by means of which the cables are initially held in their proper directional orientation within the concrete beam form preparatory to pouring of the concrete into the form, and the nature of which hold-down devices will now be more fully described and subsequently claimed.

Referring now to FIGS. 2 to 7, inclusive, and particularly to FIG. 2, wherein one of the hold-down anchor devices 12 has been illustrated in detail, and considering only the over-all configuration of the device without giving consideration to the component parts thereof, the device 12 is in the form of an elongated tubular body or hub 20 which is generally square in transverse cross section and from which there extend outwardly in radial fashion and opposite directions two coplanar side wings 22, each wing being formed with four undercut notches 24, each notch being designed to receive therein one of the tensioning cables 14 for cable-deflection purposes. The various notches 24 are of approximately the same size and shape and each notch is formed on an approximately 45° bias and is provided with rounded side edges 26 and a rounded bottom edge 28 in order to enhance the frictional characteristics of the device when in contact with the cables and, thus, prevent damage to the cables in the event that any sliding component of motion of the cables through the notches is involved during cable-tensioning operations.

The above description of the hold-down anchor device 12 of FIG. 1 has, as previously stated, been made on the basis of the outward appearance of the assembled device. Actually, the device is made up of two identical main

body castings including an upper body casting 30 (see FIG. 3) and a lower body casting 32, together with a connector part 34 which may be in the form of a casting or may be machine cut, means of which the two castings 30 and 32 may be assembled upon each other and fixedly and rigidly held in position to produce the hereinbefore described composite hold-down anchor device 12.

The two body castings 30 and 32 are identical in construction and, therefore, a description of one will suffice for the other. Each body casting, in addition to the previously-mentioned hub 20 and notched side wings 22, is provided with a central bore 40 having upper and lower open ends or rims 41 and 43, the bore extending axially and centrally through the hub 20, as best seen in FIG. 7, and being provided with internal female contour threads including a series of upper threads 42 and a series of lower threads 44. The medial region of the bore is provided with a short unthreaded area 46. Both series of threads are of the same pitch, and preferably, they are right-hand threads.

The connector part 34 is in the form of an elongated externally threaded rod, the male threads 48 thereof extending uninterruptedly from one end of the rod to the other. The threads 48 are right-hand threads which are designed for mating threaded engagement with the female contour threads 44 and 42 of the castings 30 and 32 respectively.

The diameter of the unthreaded area 46 of the bore 40 of each body casting is somewhat less than the over-all diameter of the connector part 34 so that there exists an internal annular shoulder and, thus, this unthreaded area serves as a limit stop to determine the maximum threaded extent to which the connector part 34 may be threaded into the bores 40 of the two body castings 30 and 32. The length of the connector part 34 is slightly less than the distance between the two unthreaded areas 46 of the body castings 30 and 32 when these two castings are positioned in contiguity and end-to-end relationship as shown in FIG. 2. Thus, in order to assemble the three parts which entirely comprise the hold-down anchor device 12, the connector part 34 is first threaded either into the lower end of the casting 30 or into the upper end of the casting 32 to the fullest extent of which it is capable of being threaded, after which the other casting is threaded onto the connector part 34 in such a manner that its undercut notches 24 correspond directionally to the first casting.

In designing the female contour threads 42 and 44 of the body castings 30 and 32, thread commencement and thread termination are calculated according to engineering expediencies so that when the two castings are threaded onto the connector part 34 to the fullest extent to which they are capable of being threaded and with the castings 30 and 32 in end-to-end abutting relationship so that the lower open end or rim 43 of the upper casting 30 abuts the upper open end or rim 41 of the lower casting 32, the side wings 22 of the castings will be in substantial vertical alignment so as to complete the previously described hold-down anchor contour or shape. With the two body castings 30 and 32 thus positioned, the side wings thereof will extend in substantially coplanar relationship so that they will be properly oriented for reception of the eight cables 14 in the corresponding eight notches 24. Additionally, the adjacent female contour threads of the two body castings 30 and 32 will, in effect, constitute uninterrupted continuations of each other.

Referring now to FIGS. 1 and 8, only the flat base 50 of the concrete beam form has been illustrated therein.

The hold-down anchor device 12 is adapted to be installed within the form by a so-called "pull-down" method wherein the cables 14 have their ends anchored to suitable reaction points adjacent to the ends of the concrete beam form so that these cables initially extend under a moderate degree of tension longitudinally along the form coextensively therewith adjacent to the upper regions of

5

the latter or slightly thereabove. The composite or sectional hold-down anchor device 12 is then interposed between the two adjacent tiers of cables and the cables are inserted into the notches through the open ends thereof on each side of the device. The hold-down device 12 is then pulled bodily downwardly towards an opening 51 in the base 50 of the beam form. The shank of a lag bolt 52 is first passed through a pull-down bracket 54 and is then threaded into the bore 40 of the lower body casting 32 and caused to traverse the female contour threads 44 until the end of the lag bolt encounters the unthreaded area 46 in the medial region of the bore in the lower body casting. A pull-down cable 56 is then connected to the bracket 54 and suitable hydraulic or other mechanism (not shown) is employed to tension the cable 56 and pull the entire assembly including the hold-down anchor device 12, the lag bolt 52, and the bracket 54 downwardly to apply tension to the various cables 14 and pull them taut and into the proper position which they will assume when the concrete for the beam 10 is poured. After the concrete has been poured and has become hardened or set, the projecting or overhanging ends of the cables 14 at the ends of the beam are severed flush with the end faces of the beam and the beam form is dismantled. Finally, the pull-down cable 56 and the bracket 54 are released by severing the shank of the lag bolt 52 flush with the bottom face of the beam.

It will be understood that the hold-down anchor device 12 that is illustrated herein is one that may be built up on the field from two body castings and one connector part so as to accommodate eight cables. If ten or twelve cables are to be operated upon simultaneously, a similar hold-down anchor device may be assembled in the field, utilizing three of the body castings and two connector castings.

Under certain circumstances, it may be found desirable to utilize a single hold-down anchor casting such as the casting 30 as the sole cable restraining device. In such an instance, the pull-down method of cable tensioning may be resorted to utilizing a lag bolt 52 for this purpose. However, since no connector casting 34 is required when a single body casting 30 is employed, the central bore 40 in the casting will not be obstructed for passage of a strand of waste cable therethrough in the performance of a "push-down" operation for cable-tensioning purposes. One expeditious push-down method of cable tensioning has been shown and described in United States Patent No. 3,006,114, and reference may be had thereto for a full understanding of such a method. Briefly, the method consists in passing a short length of waste cable through the bore 40 and then upwardly through a conventional cable vice and also through a center hole hydraulic ram. A second cable vice above the ram anchors the upper end of the cable, while suitable reaction means are provided outside the concrete beam form for holding the lower end of the cable. When the ram is extended, the upper cable vice prevents upward movement of the ram while the lower cable vice allows the ram to push the latter vice, the body casting 30 and the casting-engaged cables 14 downwardly bodily as a unit until the desired degree of cable tension has been attained. Ram pressure is then released and the lower cable vice holds the body casting 30 in its depressed position. The concrete beam form is then ready for pouring operations. After the concrete has become set, the waste cable is severed at the top and bottom surfaces of the finished beam, and the ram and upper cable vice are released for reuse.

It is to be noted that in the form of the invention described above, when plural body castings 30 and 32 are employed in superposed relationship, the opposite pulling forces which are exerted upon the castings, especially the lowermost casting in a series, will exert unsupported tensional stresses upon the medial regions of the castings in the vicinity of the voids which exist between adjacent connector screws 34, or between the lag bolt 52 and the

6

next adjacent connector screw 34. To obviate such imposition of tensional stresses, it is contemplated that the restriction which is afforded by the unthreaded area 46 may be omitted and that the central bore 40 of the body casting be uninterruptedly threaded internally and coextensive of its length. Such a body casting has been illustrated in FIG. 9 and constitutes a modified form of the invention.

The body casting of FIG. 9 has been designated in its entirety at 130 and because of its similarity to the body casting 30, similar reference characters but of a higher order have been applied to the corresponding parts as between the disclosure of FIGS. 7 and 9 to avoid needless repetition of description. The body casting 130 is adapted to be employed in connection with a lag screw 152 of such axial extent that it may pass completely through one or more of the body castings 130, depending upon the number of such castings employed. It may also be employed in connection with similarly elongated connector parts, such as the part 48, the latter being made of the required length to accommodate the number of castings 130 employed.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification as various changes in the details of construction may be resorted to without departing from the spirit or scope of the invention. Therefore, only insofar as the invention has particularly been pointed out in the accompanying claims is the same to be limited.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. As a new article of manufacture, a composite sectional hold-down anchor device for positioning the tensioning cables of a prestressed concrete beam within a beam form preparatory to concrete pouring operations, said anchor device comprising two upper and lower body castings of identical size and configuration, and a connector part, each of said two body castings comprising a tubular hub portion from which there extend in radial fashion on opposite sides thereof a pair of side wings, said side wings being formed with open-ended notches which extend inwardly and upwardly toward the hub portion for reception therein of respective tensioning cables and for assimilation of the upward thrust of such cables when the same are drawn taut, said tubular hub being formed with internal contour threads, said connector casting being in the form of an elongated rod having external contour threads thereon, said body castings being disposed in coaxial end-to-end abutting relationship with their side wings extending in coplanar relationship and with the lower open rim of the upper body casting bearing against the upper open rim of the lower body casting so that the contour threads of the two body castings, in effect, are continuous from one casting to the other, said connector part being in the form of a threaded rod and having a portion thereof threadedly and telescopically received in the lower end of the upper body casting and having another portion thereof threadedly and telescopically received in the upper end of the lower body casting and serving to draw the two body castings hard against each other.

2. As a new article of manufacture, a composite sectional hold-down anchor device as set forth in claim 1 and wherein the medial region of the bore in each body casting is provided with a fixed obstruction which constitutes a limit stop for limiting the extent to which the connector part may be threadedly received in such bore.

3. As a new article of manufacture, a composite sectional hold-down anchor device as set forth in claim 1 and wherein said fixed obstruction is in the form of an internal annular shoulder within the bore.

4. As a new article of manufacture, a composite sectional hold-down anchor device as set forth in claim 1 and wherein the length of said connector part is less than the axial extent of either body casting so that the opposite

ends thereof terminate within the body castings respectively.

References Cited by the Examiner

UNITED STATES PATENTS

1,263,867	4/1918	Davidson	254—29.5
1,943,879	1/1934	Rea	287—125 X
3,006,114	10/1961	Hillberg	52—225

3,013,322	12/1961	Carr	52—225 X
3,049,786	8/1962	Jones	25—118
3,091,897	6/1963	Hillberg	52—225
3,106,803	10/1963	McRobbie	52—225
3,230,678	1/1966	Eriksson et al.	52—226

FRANK L. ABBOTT, *Primary Examiner.*
M. O. WARNECKE, *Assistant Examiner.*