Sept. 3, 1968 W. F. KELLY 3,399,437

APPARATUS FOR POST-TENSIONING PRESTRESSED CONCRETE

Filed April 11, 1967 2 Sheets-Sheet 1

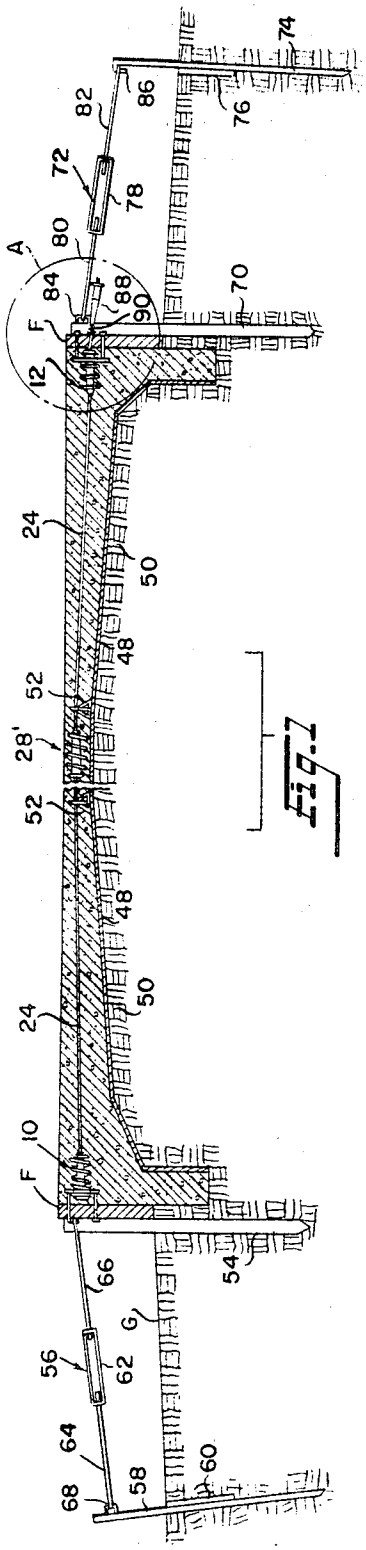


FIG. 1

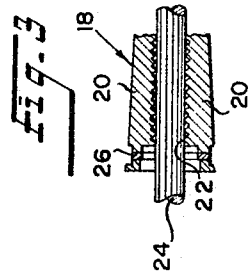


FIG. 3

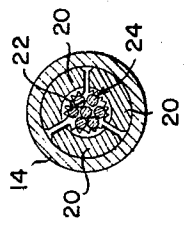


FIG. 4

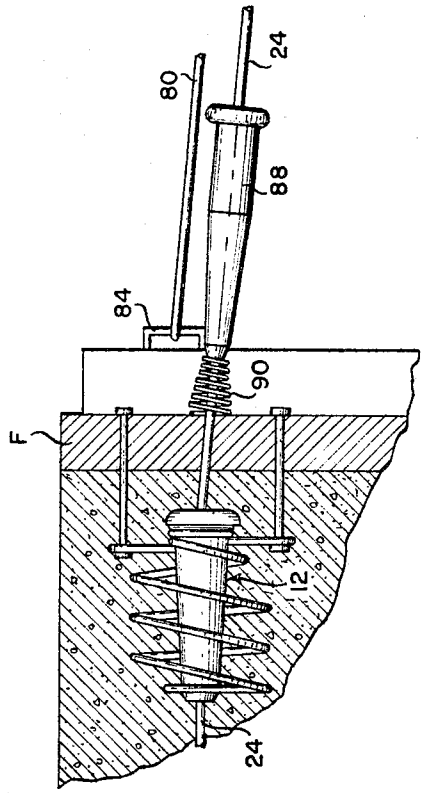


FIG. 2

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APPARATUS FOR POST-TENSIONING PRESTRESSED CONCRETE

Filed April 11, 1967 2 Sheets-Sheet 2

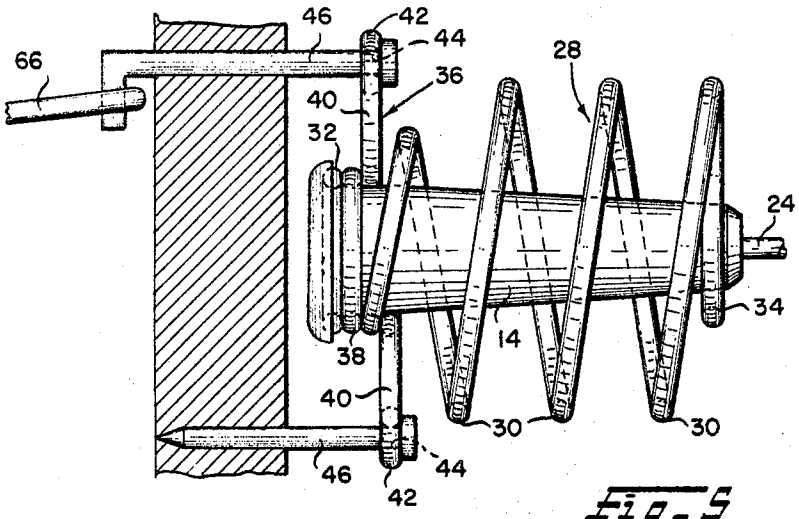


Fig. 5

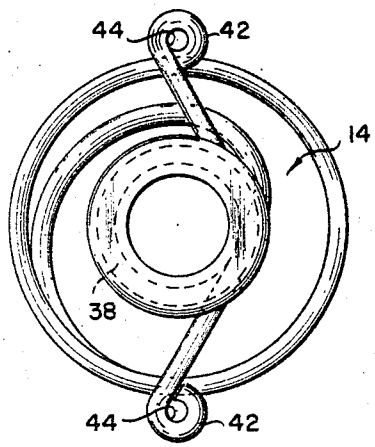


Fig. 6

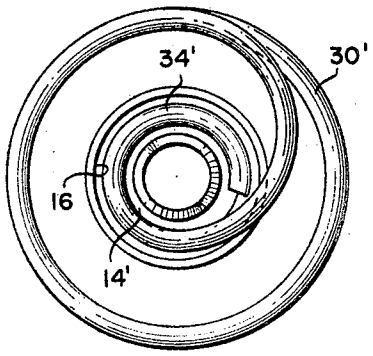


Fig. 8

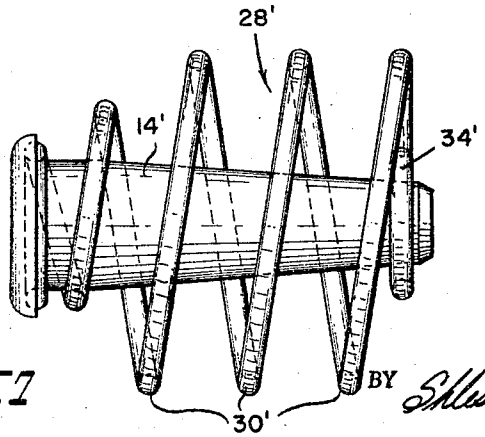


Fig. 7

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3,399,437

APPARATUS FOR POST-TENSIONING PRESTRESSED CONCRETE

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Continuation-in-part of application Ser. No. 490,421, Sept. 27, 1965. This application Apr. 11, 1967, Ser. No. 630,087

6 Claims. (Cl. 25—118)

ABSTRACT OF THE DISCLOSURE

The post-tensioning of prestressed concrete by means of forms between which concrete is to be poured, a dead end anchor secured to one form and a live end anchor secured to an opposite form, each anchor including a tapered case, a jaw assembly within the case for engagement with a tensioning member extending therebetween, a helix circumjacent the outer periphery of the tapered case to effect stress distribution, the cases adjacent forms being provided with fastening members to facilitate securement to the forms, means engaged with the tensioning member adjacent the outer face of the live anchor form for prestressing the tensioning member, and spring means interposed between the prestressing means and form for permitting a limited movement of the tensioning member between the forms when a predetermined force is exerted thereon.

This invention is directed to apparatus for post-tensioning prestressed concrete, and is a continuation-in-part of application Ser. No. 490,421, filed Sept. 27, 1965.

OBJECTS AND DESCRIPTION OF DRAWING

An object of this invention is to provide a series of spaced tensioning assemblies, each assembly including a dead end anchor unit, secured to one end of the concrete form, and a live end anchor unit secured to an opposed form, the anchors being equipped with appurtenances for supporting and holding the terminals of a high-strength tensioning member or tendon, which is stressed to a predetermined tautness before pouring the concrete or other material, means being provided for permitting limited movement of the tensioning member between the forms upon exertion of a predetermined force thereon, the appurtenances also including means positioned near each anchor and adjustably connected to the opposite ends of the member, the means including, inter alia reaction plates embedded in the earth and supported by reaction stakes to complete the force couple through the earth.

Another object of the invention is to provide apparatus of the character described wherein the means for permitting limited movement of the tensioning member embodies a convolute spring around the tensioning member between the live anchor form and the means for exerting the tautness on the tensioning member, the spring being compressed when a predetermined force is exerted on the tensioning member between the forms, resulting in a limited "giving" of the tensioning member.

Another object of the present invention is to provide dead end and live end anchors, both of which include a tapered case, in which is a jaw assembly for engaging the tensioning member, and a helix located circumjacent the outer periphery of the tapered case to effect stress distribution.

A further object is to provide an anchor, as described, with the addition of a fastening member coiled about the tapered case, the terminals of the fastening member being formed to provide loops adapted for the reception of fastening means for securing the anchors to forms.

Other objects of the invention will be manifest from

the following description of the present preferred forms of the invention, taken in connection with the accompanying drawings, wherein:

FIGURE 1 is a fragmentary side elevational view illustrating the apparatus of the present invention installed between forms and illustrating the tensioning member in prestressed condition;

FIGURE 2 is an enlarged plan view of Detail A of FIGURE 1;

FIGURE 3 is a longitudinal sectional view, illustrating to advantage a portion of the jaw assembly forming a part of the anchor of the present invention;

FIGURE 4 is a transverse sectional view of an anchor with the helix removed;

FIGURE 5 is an enlarged top plan view of the apparatus of the present invention illustrating to advantage the construction of the case helix and fastening loop, and the manner of securing the anchor to a form;

FIGURE 6 is an end elevational view of the anchor of the present invention per se;

FIGURE 7 is an elevational view of a modified form of anchor made in accordance with the present invention, and

FIGURE 8 is an end elevational view of the form of the present invention illustrated in FIGURE 7.

The apparatus of the present invention is illustrated for post-tensioning a prestressed poured-on-grade concrete slab, but is susceptible of use for any purpose to which an anchor for post-tensioning prestressed concrete or other suitable material can be applied.

In FIGURE 1, a pair of anchors are illustrated, the dead end anchor unit being designated **10** and the live end anchor unit being designated **12**, both units being of the same basic construction as set out in copending application Ser. No. 490,421.

As shown to advantage in FIGURES 3 to 6, each anchor includes a tapered case **14**, the terminal portion of a large end of which is flarer outwardly to provide an annular peripheral recess **16**. A jaw assembly **18** of the type illustrated and described in application Ser. No. 490,421 is positioned in tapered case **14**, which jaw assembly is shown to advantage in FIGURES 3 and 4. Jaw assembly **18** includes jaw segments **20** having teeth **22** for engagement with tensioning member or tendon **24**. Jaw segments **20** are preferably joined together by a resilient band **26**.

In accordance with the objects of the present invention, a helix generally designated **28** is positioned circumjacent tapered case **14** and is substantially coextensive therewith. It will be noted from a consideration of FIGURE 5 that the intermediate portion of helix **28**, indicated at **30** is in substantially spaced relationship to the outer periphery of tapered case **14**. One terminal of the helix, however, is reduced, as indicated at **32**, for contiguous engagement with the enlarged portion of tapered case **14**, the extreme terminal being adapted to be received by annular peripheral recess **16**; the opposite terminal of helix **28** is also reduced as indicated at **34** for positioning proximate the nose of case **14**. This maintains alignment of the helix on the approximate axis of the case and tensioning member.

In order to facilitate attachment of the anchor to a form, there is provided a fastening member generally designated **36** which is adapted for attachment to tapered case **14** at a point near the terminal of the larger end thereof. Fastening member **36** includes a central portion **38** which is coiled around and in contiguous engagement with the outer periphery of case **14**. The terminals of fastening member **36** are extended outwardly at **40** beyond the limits intermediate coiled section **30** of helix **28**, and issue into loops **42** having apertures **44**, as shown in FIGURES 5 and 6.

Anchors **10** and **12** and fastening member **24** are adapted to be positioned between forms F, anchors **10** and **12** being secured to the forms by nails **46** or the like which extend through apertures **44** of fastening member **36**, as shown in FIGURES 1 and 5. The apparatus of the present invention is arranged in a similar manner to that shown and described in connection with application Ser. No. 490,421. Referring to FIGURE 1, there is illustrated the apparatus of the present invention and appurtenances for a poured-on-grade concrete slab, wherein a visqueen membrane **48** or the like is spread over compacted fill **50**. Conventional chairs **52** are positioned intermediate forms F for supporting engagement with tensioning member **24**.

Forms F are held in place by anchoring stakes **54** which are driven into the ground. Dead end anchor **10** is adjustably connected to reaction means **56** comprising a steel reaction stake **58** and a steel reaction plate **60**, the latter being completely embedded in the ground G and secured to stake **58** which is driven into the ground at an angle, as shown in FIGURE 1. Adjustment of tension on dead end anchor **10** is effected by a turnbuckle **62** threadedly connected to rods **64** and **66**. A free terminal of rod **64** is secured to a hook **68** and the free terminal of rod **66** is engaged with a bent portion of a nail **46** used to secure anchor **10** to form F.

Form F holding live end anchor **12** is in turn supported by a stake **70** driven into ground G, to which reaction means **72** are connected. Reaction means **72** includes a steel stake **74** engaged with a reaction plate **76** which is completely embedded in the ground. Adjustment of tension is effected by a turnbuckle **78** threadedly connected to rods **80** and **82**. The free terminal of rod **80** is secured to a hook **84** fixed to stake **70** and the free terminal of rod **82** is engaged with a hook **86** carried by stake **74**.

In accordance with one of the objects of the present invention, there is provided means for lightly pretensioning member **27**. This means includes a pretension anchor **88** which may be of conventional type, such as the Strandvise anchor manufactured by Reliable Electric Company. It is a salient feature of the present invention to provide, in association with pretensioning anchor **88**, a prestressing spring **90** which, as shown in FIGURE 2, is interposed between anchor **88** and form F. Pretensioning spring **90** is preferably a standard die-set type spring with a one half inch hole for the reception of a three-eighths inch tensioning member, a spring with a proportionately larger size hole being employed for tensioning members of larger diameter. Optimum results have been obtained with a pretensioning spring in the "blue" strength range which in the three-eighths inch size produces a compressed loading of approximately two hundred fifty pounds for a three-quarters inch spring closure which has been found to be adequate for the purposes of the present invention.

OPERATION

In use of the present invention a plurality of anchors and tensioning members are preferably arranged in spaced parallel relation in the manner illustrated in FIGURE 1. After this has been done, tensioning member **24** is drawn taut through live anchor **12** until the desired tautness has been effected. Pretension anchor is then set to maintain the desired tension of member **24**. In the event that undue stress is exerted on tension memhber **24** between forms F, such as by persons walking thereon or placing a weighty object on the member, prestressing spring **90** is compressed under the force, resulting in slight movement of pretensioning anchor **88** in the direction of form F and resultant "giving" of tensioning member **24** under the weight applied thereto. Upon removal of the weight, pretensioning spring **90** exerts a force on pretensioning anchor **88** to return the latter to its initial position, with a corresponding movement of tensioning member **24** between forms F. In this way, damage to the forms and connected parts is obviated.

When concrete or other material is poured between forms F, members **24** maintain the position shown in FIGURE 1 spaced from membrane **48**.

Helices **28** of anchors **10** and **12** act to lend greater strength and flexilibity than has heretofore been possible with better calculated stressed distribution, resulting in a superior anchor.

After the concrete has been poured and permitted to harden, forms F is removed, following which member **24** is post-tensioned with jacking equipment of the type disclosed in application Ser. No. 560,463 filed by me June 27, 1966. The terminals of nails **46** beyond the concrete may be cut off or removed in any other suitable fashion.

EMBODIMENT OF FIGURES 7 AND 8

In FIGURES 7 and 8 there is illustrated a modified form of the anchors of the present invention, which is similar to anchors **10** and **12** illustrated in FIGURES 1 through 6. Accordingly, like portions thereof are identified by like, primed numbers. It will be noted, however, that in this form of the invention no fastening member corresponding to member **36** of the form of invention illustrated in FIGURES 1 through 6 is employed. This embodiment of the invention is used when multiple anchors are ganged together intermediate the concrete forms where no fastening means is necessary, or are built to fit special conditions.

While preferred embodiments of the present invention have been shown and described, it is nevertheless to be understood that various changes may be made therein without departing from the spirit and scope of the claims hereto appended.

I claim:

1. An assembly for use in the post-tensioning of prestressed concrete comprising
- (a) spaced building forms between which concrete is to be poured,
- (b) a dead end anchor adjacent one of said forms,
- (c) a live end anchor adjacent the other of said forms in opposed relation to said dead end anchor,
- (d) means securing said anchors to the opposed faces of said forms,
- (e) a tensioning member fixedly held at one end to said dead end anchor by jaw segments,
- (f) the opposite end of said tensioning member being stretched through and beyond said live anchor containing jaw segments,
- (g) a jaw assembly retaining means adjacent the external face of the live anchor form holding said tensioning member under predetermined tension, and
- (h) means interposed between said retaining means and the live anchor form permitting limited movement of said tensioning member between said forms upon application of a predetermined force thereto.

2. The assembly of claim **1**, wherein
- (a) said means interposed between said retaining means and the live anchor form is a convolute spring.

3. The assembly of claim **1**, with the addition of
- (a) at least one additional anchor engaged with said tensioning member immediate said forms.

4. The assembly of claim **1**, wherein said live and dead end anchors each comprise
- (a) a tapered case,
- (b) tensioning member engaging elements within said tapered case, and
- (c) a helix engaged with an extending circumjacent, the outer periphery of said tapered case to effect stress distribution.

5. The assembly of claim **4**, with the addition of
- (a) a fastening member around the outer periphery of the live and dead end cases, said fastening member including
- (b) means adapted for the reception of a fastening element for securing the fastening member and connected anchor to the form.

6. An anchor for use in the post-tensioning of prestressed concrete comprising

(a) a tapered case,

(b) a jaw assembly slidably mounted in the case,

(c) said jaw assembly including jaw segments having teeth for gripping engagement with a tensioning member passed therebetween,

(d) a helical spring positioned circumjacent the outer periphery of said tapered case to effect stress distribution,

(e) said helical spring being substantially coextensive with the length of said tapered case, and

(f) a fastening member coiled around said tapered case,

(g) the terminals of said fastening member issuing into loops adapted for the reception of fastening elements.

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