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Edwards

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[45] **Oct. 29, 1974**

[54] **TENDON ANCHORAGE ASSEMBLY WITH THREADED SUPPORT MEMBER FOR CONCRETE FORMWORK**

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[21] Appl. No.: **164,073**

Related U.S. Application Data

[63] Continuation of Ser. No. 755,577, Aug. 27, 1968, abandoned.

[52] **U.S. Cl.** **425/111,** 24/126, 52/223, 249/217

[51] **Int. Cl.** **B28b 21/60**

[58] **Field of Search** ..... 249/205, 207, 210, 213, 249/215, 216, 219, 48, 50, 40–43, 217; 24/126, 124, 26; 52/223, 225, 230; 287/103 A, 20; 425/111; 285/162

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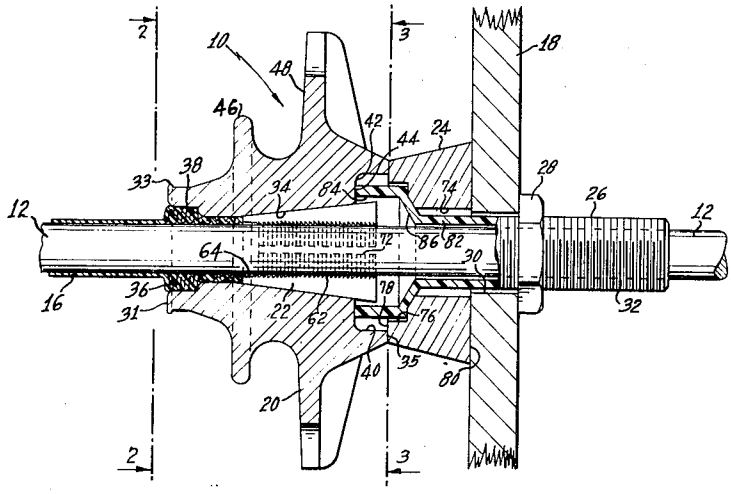
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Assistant Examiner—John McQuade
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[57] **ABSTRACT**

An anchorage assembly including an anchor having a hollow housing and means therein for engaging a stressing tendon passing therethrough. The assembly includes a hollow member removably attached to the anchor housing and to the concrete formwork and fixing the relative position of the anchor housing to the formwork. The member surrounds the tendon between the anchor housing and the formwork and is adapted and arranged to be detached from the anchor housing after the concrete has set. A cavity forming spacer is provided which surrounds the member and is disposed between and seals against the anchor housing and the formwork to form a cavity in the concrete. The spacer is adapted and arranged to be removed from around the member after the concrete has set.

40 Claims, 11 Drawing Figures



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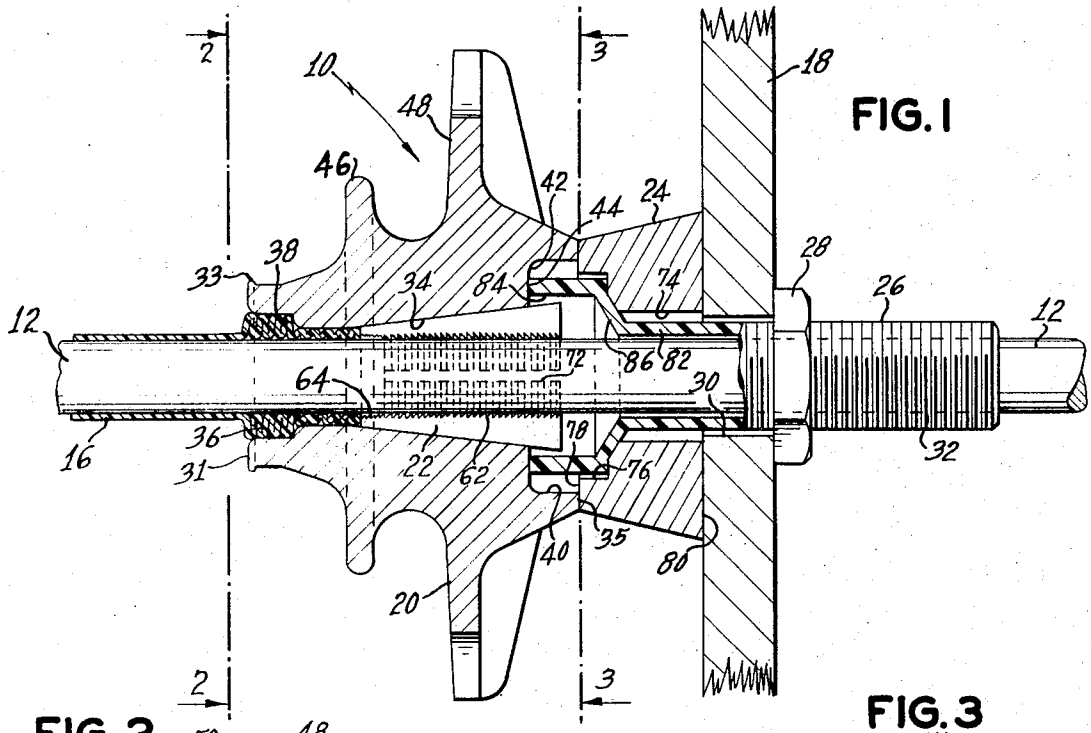


FIG. 1

FIG. 2

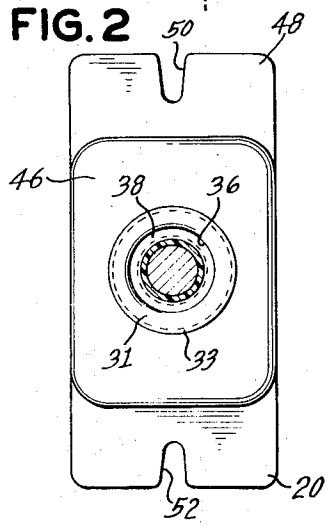


FIG. 4

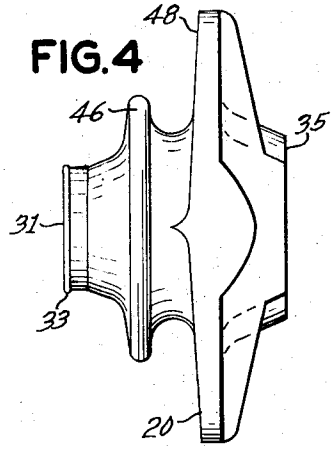


FIG. 3

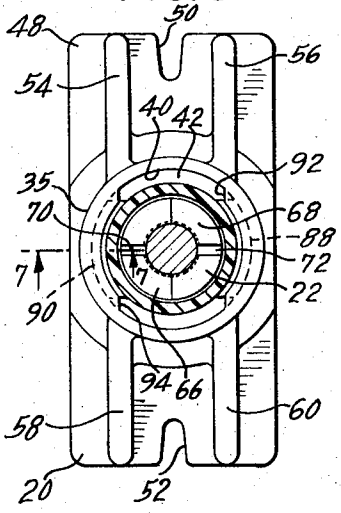


FIG. 6

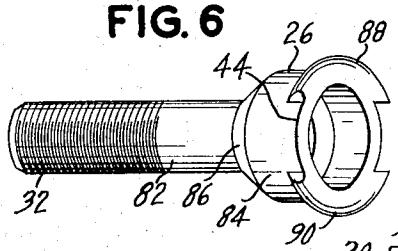


FIG. 5

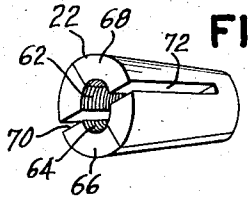
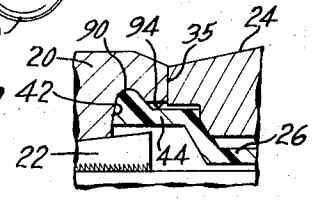


FIG. 7



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FIG. 8

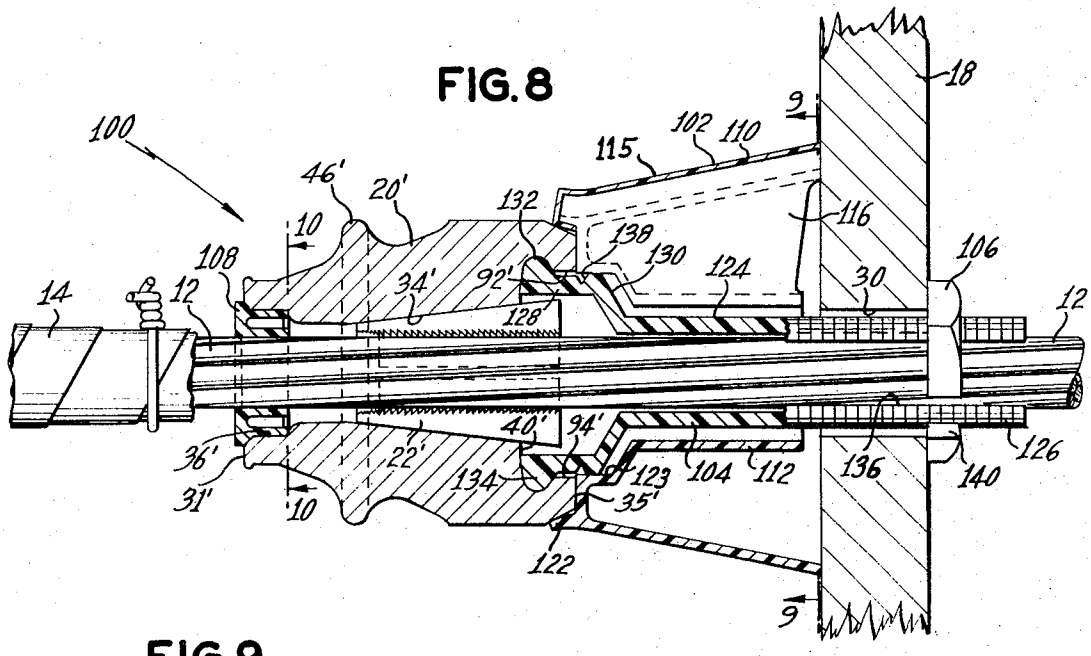


FIG. 9

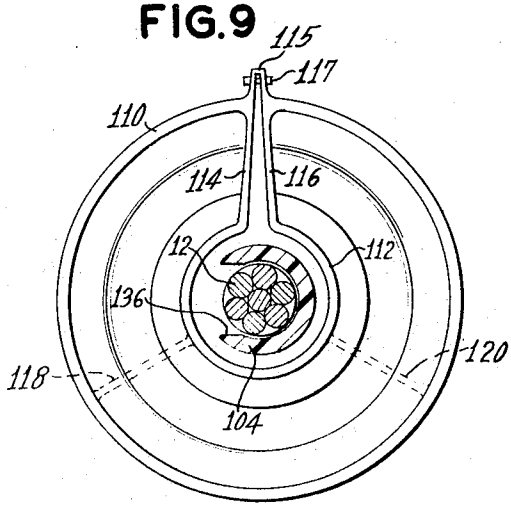


FIG. 10

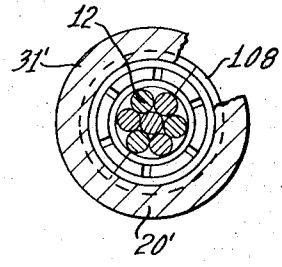
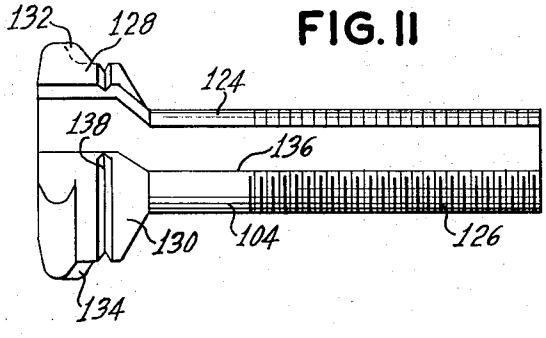


FIG. 11



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TENDON ANCHORAGE ASSEMBLY WITH THREADED SUPPORT MEMBER FOR CONCRETE FORMWORK

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of application Ser. No. 755,577, filed Aug. 27, 1968, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the post-tensioning of concrete structures by means of wire or strand cables. In particular this invention concerns an anchorage device or assembly and parts thereof for use in anchoring a cable or cables in a concrete structure. In greater detail the invention pertains to anchorages for concrete stressing tendons, particularly to anchorage assemblies for use in the tensioning of such tendons positioned within concrete structures after the concrete has set or cured.

For many years mold, low strength steel reinforcing was simply imbedded in ordinary concrete and the result wa an improvement in the strength of the concrete and some resistance to cracking and other failures was obtained. Later there was an attempt to place this reinforcement under tension so that it would have a compression effect upon the concrete. This slightly improved the construction although the success of this effort was not great because those who did it did not appreciate the fact that concrete would flow slightly under pressure thus that tension on the reinforcement would be reduced practically back to zero. Also under tension, the reinforcement itself would suffer from some permanent elongation that would add to this reduction of the tension. Accordingly, the tensioning of the reinforcement was not generally considered to be of great importance until recently when some of the factors influencing the effectiveness of reinforcement became better known and it was found that if steel wire having a very high tensile strength was used and placed under a very high tension, then although a part of the tension was lost by plastic flow and shrinkage in the concrete and permanent elongation or creep in the wire, nevertheless sufficient tension would remain in the wire and sufficient compression would result on the concrete to cause a major increase in the load-carrying capacity of the concrete and a major increase in the resistance of the concrete to cracking and the like. This represented such a complete departure from previously known facts to present completely new concept in reinforced concrete and hence this high tension wire reinforcing of concrete was probably considered to furnish a completely new and different approach to reinforced concrete construction. At the time that the possibility of using high-tension wire reinforcement came into being a general idea of tensioned reinforcement had long been known and considered of relatively little value. The discovery that high-tensioned wire reinforcement could produce far stronger and more duable structures than had ever before been known was a discovery that revolutionized the manufacture of reinforced concrete structures.

2. Description of the Prior Art

Anchors or anchorage assemblies for use in the post-tensioning of stressing tendons within concrete structures have been previously devised, such prior art devices are generally disclosed in U.S. Pat. No. 3,293,811. Applicant's invention of an improved anchorage assembly disclosed herein is an improvement over such prior art anchorage devices or assemblies, as shown for example in the above mentioned patent.

SUMMARY OF THE INVENTION

Therefore it is an object of the invention to provide an improved anchorage assembly for concrete stressing tendons of the type which are cast in place in such a manner that they may be tensioned after the concrete has set or been cured.

Another object of this invention is to provide an improved anchorage assembly for concrete stressing tendons in which there is utilized a single piece, wedge receiving and constraining plate anchor housing.

Still another object of the subject invention is to provide an anchorage assembly for concrete stressing tendons which includes a cavity forming spacer initially held in being engagement with the wedge receiving anchor housing and in being engagement with the concrete formwork when anchorage is secured to the formwork such as to provide a grout receiving cavity, the spacer forming an effective seal with the wedge receiving anchor housing to exclude concrete therefrom where the concrete is being poured and cured.

Yet another object of the instant invention is to provide means whereby a tendon anchoring housing is imbedded in the concrete at the time the concrete is poured and by which means the anchor housing is attached to the formwork, and after the concrete has set the means permitting the formwork to be released from the anchor housing.

A further object of this invention is to provide an improved anchorage assembly for concrete stressing tendons wherein portions of the anchorage assembly may be salvaged and later re-used.

Yet a further object of the invention is to provide an anchorage assembly which will permit the anchor housing thereof to be left in the concrete and which anchor housing when left in the concrete will not produce an unsightly appearance.

In general these and other objects are attained by providing an ahcorage assembly including an anchor having a hollow housing and means therein for engaging a stressing tendon passing therethrough. The anchorage assembly includes a member removably attached to said housing and to the formwork, this member fixing the relative position of the anchor housing with respect to the formwork. The member is additionally adapted and arranged to be detached from the anchor housing after the concrete is set.

The concrete objects produced in accordance with the apparatus of this invention may be of any desired shape but are generally beams, columns, channels, slabs or other like structural members. In accordance with this invention, the concrete objects are comprised of three essential parts, namely, the concrete itself, reinforcing members or tendons and the end anchorages that transfer the load of the reinforcing tendons to the concrete.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features which are believed to be characteristic of this invention are set forth with particularity in the appended claims. The invention itself, however,

both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a side elevational view, portions thereof being in cross-section, of the improved anchorage assembly of this invention;

FIG. 2 is a left-hand end view taken along line 2—2 of FIG. 1;

FIG. 3 is a cross-sectional view taken along line 3—3 of FIG. 1;

FIG. 4 is a side view of the anchor housing shown in FIGS. 2 and 3;

FIG. 5 is a prospective view of the wedges used in the assembly of FIG. 1;

FIG. 6 is a prospective view of the reusable bayonet fitting used in the assembly of FIG. 1;

FIG. 7 is a transverse-sectional view taken along line 7—7 of FIG. 3;

FIG. 8 is a cross-sectional view showing a second embodiment of the anchorage assembly of the invention;

FIG. 9 is a cross-sectional view taken along line 9—9 of FIG. 8;

FIG. 10 is a cross-sectional view taken along line 10—10 of FIG. 8; and

FIG. 11 is a top plan view of the reusable bayonet fitting used in the assembly of FIG. 8.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, and in particular FIG. 1 thereof, the anchor or anchorage assembly 10 of this invention is depicted therein retaining an appropriate strand or tendon 12 to be used in the construction of a concrete beam, column, slab or the like. Cable or tendon 12 when used with the anchorage assembly of this invention in its intended application is often of the non-bonded type. This type of cable (non-bonded) comprises the normal pre-stressing cable which before delivery to the site is pre-cut and coated with a special protection and lubricating compound which guards against corrosion and minimizes friction during the stressing operation. The thus coated cable is wrapped in a special heavy duty reinforcing paper 14, as in FIG. 8, or a plastic sleeve or sheathing 16 is fitted over the entire length of the strand as in FIG. 1. In both cases the strand is free to move within the covering. When the cable arrives at the site it is simply laid out in position and appropriate anchorage assemblies, such as at 10, are located on the ends thereof interiorally of the formwork or shuttering 18. AFter this the concrete is placed within the form with the anchor assembly 10 being recessed therein. When the concrete has set the tendon is then stressed by jacks which bear against the back of the anchor housing.

Assembly 10 generally includes a tendon anchor or housing 20, see in particular FIGS. 2 through 4; grips or teethed wedges 22, see in particular FIG. 5; a recess or pocket former or spacer 24 for recessing anchor 20 into the concrete; and a releaseable bayonet fitting or member 26, see in particular FIG. 6, for maintaining the assembly 10 in assembled form and when employed in combination with a nut 28 maintaining the complete and assembled assembly firmly in position with respect to the shuttering or formwork 18 at any desired location thereon. The assembly is positioned on the formwork 18 at the desired location by means of a hole or opening 30 extending therethrough and the bayonet fitting 26 of the assembly being positioned therethrough and secured thereto by means of nut 28 being tightened on a threaded portion 32 of bayonet fitting 26.

The anchor or anchor housing 20 of anchor assembly 10 includes a forward end portion 31 having an outwardly extending lip 33, a rearward end portion 35, and a conical-shaped bore or hollow passageway 34 extending therethrough and through which strand or tendon 12 passes. Bore or hollow 34 is provided with an enlarged forward portion or passageway 36 having a forwardly facing shoulder 38 against which sheathing 16 abuts whereby the same bunches up within enlarged portion 36 to prevent the concrete from entering internally into the anchor assembly from this its forward end portion 31. Bore or hollow 34 is further enlarged by cavity 40 adjacent the rearward end portion 35 of anchor 20 to form a rearwardly facing shoulder 42, against which the forward end portion 44 of releaseable bayonet fitting abuts. Anchor 20 further includes a rib or flange member 46 of a generally rectangular shape having rounded corners and positioned generally perpendicular to the axis of conical bore 34. Rib or flange 46 distributes the stressing forces into the concrete and thus reduces the stress intensities in the anchorage zone. Member 46 additionally provides a safety factor in the fact that any bad compaction of the concrete in the region of the face or forward end portion 31 of anchor 20 has less effect than would be the case if anchor housing 20 were not provided with this flange or rib 46. Body portion 20 further includes a generally rectangular shaped flange 48 extending outward therefrom and positioned generally adjacent the rearward end portion 35 thereof. Flange member 48 distributes the stressing forces into the concrete which reduces the stress intensities in the anchorage zone. Flange member 48 is provided with a slotted opening 50 in its top portion extending downward from its upper edge and a slotted opening 52 in its bottom portion extending upward from its lower edge, see in particular FIGS. 2 and 3. Slots 50 and 52 are provided such that anchor 20 may be secured to the shuttering or framework 18 by means of nails (not shown) if so desired, extending through slots 50 and 52 and into the formwork 18. Casing or anchor housing 20 is further provided with a pair of reinforcing ribs or members 54 and 56 extending from adjacent the rearward end portion 35 and adjacent opening or cavity 40 upward to to the upper outer edge of flange or plate member 48. In like manner, a second pair of reinforcing ribs or members 58 and 60 are provided and extend downward from a point adjacent the rearward end portion 35 and cavity 40 to the lower outer edge of flange member 48.

Wedges or jaws 22, see in particular FIGS. 1 and 5, have a conical shape outer surface to generally conform to the conical configuration of passageway or hollow 34 within anchor housing 20. Wedges 22 are provided with teeth or serrations 62 extending laterally round their inner opening or passageway 64 to grip and bite strand 12 passing therethrough, as depicted in FIG. 1. Jaws or wedges 22 are split and include a left 66 and right 68 member or portion to fit around strand 12 and generally conform thereto as the jaws 22 are pulled forward within bore 34. Further, each of the jaw or wedge sections or portions 66 and 68 are slit or provided with

slotted openings, respectively at **70** and **72** adjacent their mid portions, whereby the upper and lower portions of each wedge section **66** and **68** may move toward each other to generally conform to and better grasp tendon **12** passing therethrough, see also FIG. **3.**

Recess or pocket former **24** is of a conical shape having a central bore or passageway **74** extending therethrough, with an enlarged forward end portion **76** to permit bayonet fitting **26** to extend therethrough and to generally accommodate the same. Forward end portion **78** of cavity forming spacer **24** abuts rearward end portion **35** of anchor **20** to generally seal therewith to exclude the cement or grout from entering the anchorage assembly **10** at this point. In addition, rearward end portion **80** of recess former or spacer **24** abuts and generally seals with the forward edge of formwork **18** to prevent the cement from gaining access to the interior of the anchorage assembly at this particular location.

Detachable and releaseable bayonet fitting or hollow member **26** includes a circular elongated portion **82** a threaded outer end portion **32** and an enlarged circular forward portion **84** connected to portion **82** by a transition portion **86.** Elongated portion **82** extends through opening **30** within formwork **18** and through passageway or opening **74** within pocket or recess former **24.** Enlarged forward portion **84** of the bayonet fitting is positionable within the enlarged rearward portion cavity **40** of the casing or anchor housing **20** outwardly of the wedges or jaws **22** such as to not interfere with the operation of the same. The forward end portion **44** of bayonet fitting **26** which abuts rearwardly facing shoulder **42** of anchor **20** is provided with a pair **88** and **90** of flange members or shoulders (see FIGS. **3** and **7**) which respectively fit behind and engage a pair of lips or shoulders **92** and **94** provided on achor housing **20** adjacent its rearward end portion **35** and extending inward of enlarged opening or cavity **40.**

Upon proper positioning of the forward end portion **44** of bayonet fitting **26** within cavity **40** of anchor **20** and rotation or pivoting of the fitting such that flange members **88** and **90** become engaged behind lips **92** and **94,** the fitting **26** becomes releasably affixed or secured to anchor **20.** The pocket or recess former **24** is then positioned over bayonet fitting **26** with enlarged forward portion **84** thereof fitting within the enlarged forward portion **76** of pocket former **24.** Next the threaded portion **32** of elongated portion **82** of fitting **26** is positioned through opening **30** within the formwork **18,** and then nut **28** is threaded on portion **32** of bayonet fitting **26.** Transition portion **86** of bayonet fitting **26** prevents jaws or wedges **22** from coming out of their proper position within bore or hollow **34** of the anchor housing **20.** Nut **28** is tightened on threaded portion **32** to pull bayonet fitting **26** through formwork **18** causing the attached anchor **20** to tighten against pocket former **24** thereby forming a seal between pocket former **24** and formwork **18,** and between pocket former **24** and anchor **20** to prevent cement from entering the anchorage assembly **10** at these points of adjoinment. NExt the concrete is poured and placed within the formwork or shuttering. After the concrete has set, nut **28,** formwork **18,** pocket former **24** and bayonet fitting **26** are removed to afford access to the back of anchor body **20** and wedges or jaws **22** positioned therein, which are now recessed within the set concrete. The tendon may now be stressed by jacks which bear against the back of anchor housing **20,** and jaws **22** may be tapped home to firmly and snuggly grip the stressed strand **12.** After stressing tendon **12,** the opening in the concrete which was formed by the recess or cavity forming spacer **24** can be grouted-in if so desired.

With detailed reference to FIGS. **8** through **11** now, a second embodiment of the anchorage assembly **100** is depicted therein retaining strand or tendon **12,** having been wrapped with heavy duty reinforcing paper **14,** to be used in the construction of a concrete beam, column, slab or the like. Assembly **100** generally includes an anchor housing or casing **20'**, identical to that seen in FIG. **1,** grips or teethed wedges **22'**, identical to those shown in FIG. **5,** a recess or pocket former **102** for recessing casing or anchor housing **20'** into the concrete, a releaseable and detachable bayonet fitting **104,** see in particular FIG. **11,** and a split nut **106** for maintaining the assembly firmly in position with respect to shuttering or formwork **18.**

Casing or anchor housing **20'** of anchorage assembly **100** includes a forward end portion **31'**, a rearward end portion **35'** and a conical shaped bore or hollow **34'** extending therebetween, through which tendon **12** passes. Bore **34'** includes an enlarged forward portion or passageway **36'** and an enlarged rearward portion or cavity **40'**. Anchor housing **20'** further includes a flange-like member **46'** which aids in distributing and stressing forces into the concrete to thereby reduce the stress intensities in the anchorage zone, and provides a safety factor in that any bad compaction of the concrete in the region of the forward end portion **31'** of anchor **20'** has less effect than would the same if the anchor housing were not provided with this flange member **46'**. Anchor housing **20'** further includes a pair **92'** and **94'** of lips or shoulders adjacent rearward end portion **35'** extending inward of enlarged rearward opening or cavity **40'**, behind which bayonet fitting **104** is engageable, as will be explained more fully hereinbelow.

In the embodiment of the strand anchor assembly shown in FIGS. **8** through **11,** a grout or cement extruder or bushing **108** is provided which snugly and engagingly fits within enlarged forward portion or passageway **36'** of bore or hollow **34'** within anchor housing **20'**. Cement extruder **108** fits closely and snugly about tendon **12** passing therethrough such as to prevent grout or cement from entering anchor assembly **100** at this forward end portion thereof.

Recess or pocket former **102** is hollow and preferably formed from a frangible material of good release properties, such as a suitable plastic. Cavity forming spacer **102** includes an outer conical shaped shell portion **110** and an inner centrally disposed, hollow cylinder portion **112,** through which tendon **12** passes and which is connected to the outer conical shell portion **110** by suitable webs such as **114** and **116.** Webs **114** and **116** are joined or connected at **115** adjacent their outer ends to seal pocket former **102.** Additional webs, such as indicated by dotted lines at **119** and **120,** may join outer shell **110** and inner cylinder **112** to further strengthen and rigidify pocket or recess former **102.** The rearward end of inner cylinder portion **112** of recess former **102** stops short of the formwork or shuttering **118,** while the rearward edge of outer shell portion **110** of pocket former **102** extends completely to the formwork **18** to form a seal therewith when the parts

of the assembly are tightened together. The inner end **122** of outer shell **110** extends outward beyond anchor **20'** and forward of rearward end portion **35'** thereof to form an effective seal with anchor housing **20'** to prevent cement from entering the anchorage assembly at this point. The forward end portion **123** of central hollow cylinder portion **112** of recess former **102** is enlarged to generally accommodate and conform to the shape of bayonet fitting or member **104.**

Bayonet fitting **104,** which is releaseable and detachable includes a circular elongated hollow portion **124** having a threaded outer end portion **126** and an enlarged circular forward end portion **128** connected to elongated portion **124** by a transition portion **130.** Elongated portion **124** is positionable through the opening of hollow cylinder **112** of recess former **102** and through opening or passageway **30** within formwork **18.** Enlarged forward end portion **128** of bayonet fitting **104** is positionable within enlarged rearward portion or cavity **40'** of anchor housing **20'**, and a pair of flanges or shoulders **132** and **134** on forward end portion **128** of bayonet **104** are respectively engageable behind and with lips or shoulders **92'** and **94'** of anchor housing **20'**. Bayonet fitting or member **104** has a portion removed therefrom to form a slot or opening **136** extending over its entire length such that fitting **104** can be slipped transversely over or clipped on cable or strand **12,** thereby eliminating the need of threading fitting **104** over the entire length of strand **12** up to the point where it is desired to be put to use. Additionally bayonet or hollow member **104** is provided with a V-notch **138** extending about its entire circumference and positioned on enlarged forward end portion **128** adjacent transition portion **130.** V-notch **138** permits fitting **104** to be broken off at this point, such as when formwork **18** is stripped away from the hardened concrete, leaving only the enlarged forward end portion **128** with flanges or shoulders **132** and **134** of bayonet **104** in anchor housing **40'**. Alternatively fitting **104** instead of being broken off by V-notch **138** can be removed from anchor **20'** by simple rotation of and release of flanges **132** and **134** from behind lips or shoulders **92'** and **94'** and reused with another casing, similar to casing **20'**, at another point along tendon **12.**

In like manner nut **106** has a portion or section removed or cut-out from its entire thickness to provide a slot or opening **140** therealong whereby the nut may be transversely slipped over or clipped on strand **12** to eliminate threading of the nut over the entire length of strand **12** up to the point where it is intended to be used.

The embodiment of strand anchor assembly **100** depicted in FIGS. **8** through **11** has particular applicability when employed along the mid-portions or sections of a particularly long strand which is to be used in the stressing of concrete. When thus employed, using the readily slottable recess former **102,** slotted bayonet fitting **104** and slotted nut **106,** the assembly can be readily arranged and assembled on the mid-portion of the strand or tendon without the necessity of threading these portions or parts of assembly **100** over the entire length of the strand from its end to its mid-portion. In this use pocket or recess former **102** is split at reference number **115** where webs **114** and **116** are joined together and then placed or clipped over strand **12.** Next the slot so formed in recess former **102** is closed by joining webs **114** and **116** together with staples **117** or the like. Now slotted bayonet fitting **104** is clipped over strand **12** and located and secured in cavity **40'** of anchor **20'**. The pocket former **102** is then pushed over fitting **104** and the whole assembly **100** is lined up in slot or opening **30** in formwork **18,** after which split nut **106** is clipped on strand **12** and tightened on threaded portion **126** of fitting **102** against the outer face of formwork **18** adjacent opening **30** therein. When anchorage assembly **100** is used in the mid-portions of an extended tendon, anchor **20'** is usually placed on the strand in the factory at the approximate position at which it will be used before the strand is shipped to the location for use. Once the concrete has set and cured, formwork **18** is stripped by means of leverage between the formwork and the concrete, thus breaking off bayonet fitting **104** at notch **138.** Pocket former **102** is then extracted to leave anchor housing **20'** and enlarged forward end portion **128** of bayonet fitting **104** recessed within the concrete.

While only certain preferred embodiments of this invention have been shown and described by way of illustration, many modifications will occur to those skilled in the art and it is, therefore, desired that it be understood that it is intended in the appended claims to cover all such modifications as fall within the true spirit and scope of this invention.

What is claimed as new and what it is desired to secure by Letters Patent of the United States is:

1. In an anchorage assembly including an anchor having a hollow, continuous and leak proof housing and a stressing tendon passing therethrough, said anchor including flange means attached to and extending generally laterally outwardly of said housing, said flange means fixing said anchor in concrete after setting thereof whereby said anchor is inhibited from movement in a direction inwardly of the concrete, gripping means within said hollow of said housing for engaging the portion of said tendon in said housing, the improvement comprising first means for supporting said housing on a formwork and for forming a cavity in the concrete, said first means including a member extending generally longitudinally of the tendon for supportingly connecting between said housing and a formwork, fixing means for attaching said member to said housing, said first means further including a spacer surrounding said member and disposed in sealing engagement with said housing and adapted to be sealed against the formwork to prevent ingress of concrete therebetween and for forming a cavity in concrete therebetween, said member fixing the relative position of said housing to the formwork and for urging said housing toward said spacer and sealing said spacer to said housing and adapted to be sealed against the formwork and adapted to extend through said cavity formed by removal of said spacer.

2. In the anchorage assembly as defined in claim **1** wherein said member is unitary and hollow and surrounds the tendon between said housing and the formwork.

3. In an anchorage assembly including an anchor having a hollow housing and a stressing tendon passing therethrough, said anchor including flange means attached to and extending generally laterally outwardly of said housing, said flange means fixing said anchor in concrete after setting thereof whereby said anchor is inhibited from movement in a direction inwardly of the concrete, gripping means within said hollow of said

housing for engaging the portion of said tendon in said housing, the improvement comprising first means for supporting said housing on a formwork and for forming a cavity in the concrete, said first means including a member extending generally longitudinally of the tendon for supportingly connecting between said housing and a formwork, fixing means for attaching said member to said housing, said first means further including a spacer for forming a cavity in concrete between said housing and formwork, said member fixing the relative position of said anchor housing to the formwork and adapted to extend through said cavity, and means engaged on said member for attaching said member to the formwork.

4. In the anchorage assembly as defined in claim **3** wherein said means engaged on said member is disposed externally of and bearing against the surface of the formwork.

5. In the anchorage assembly as defined in claim **3** wherein said means engaged on said member includes a restraining member for urging said anchor housing toward the formwork with said spacer being sealingly interposed between said anchor housing and the formwork.

6. In the anchorage assembly as defined in claim **5** wherein said spacer includes a concrete impervious hollow collar sealing against said anchor housing and the formwork and surrounding said member for forming a cavity in the concrete, said hollow collar being adapted and arranged to be removed after setting of the concrete and removal of the formwork.

7. In the anchorage assembly as defined in claim **3** wherein said means engaged on said member for attaching said member to the formwork is bearingly disposed against the outer surface of the formwork, said means engaged on said member being adjustable along the longitudinal axis of sai member to vary the distance between said anchor housing said the formwork.

8. In the anchorage assembly as defined in claim **7** wherein said means engaged on said member includes a threaded portion on said member and a threaded nut on and engaged with said threaded portion of said member, said nut providing a bearing against the outer surface of the formwork adjacent the opening in the formwork through which said threaded portion extends.

9. In the anchorage assembly as defined in claim **8** wherein said threaded nut includes a slit, said nut being adapted to be temporarily deformed to enlarge said slit to permit transverse movement of said nut onto and around the stressing tendon and thereafter to threadedly engage said threaded portion of said member.

10. In the anchorage assembly as defined in claim **1** wherein said spacer is a conical collar and positioned with its large end portion adjacent the formwork and its small end portion adjacent the rearward end portion of said housing.

11. In the anchorage assembly as defined in claim **1** wherein said spacer is sealingly engaged with the outer end portion of said anchor housing and sealable with the inner surface of the adjacent formwork, said member squeezing said spacer between said housing and the formwork to prevent concrete from entering the anchorage assembly therebetween.

12. In the anchorage assembly as defined in claim **1** wherein said spacer is formed of flexible material whereby said spacer is readily removable from the concrete after the same has set.

13. In the anchorage assembly as defined in claim **1** wherein said spacer includes a slit in the direction of the tendon, said spacer being adapted to be temporarily deformed to enlarge said slit to permit transverse movement of said spacer over and around said member between said housing and the formwork, means for closing said slit to substantially impede concrete from entering rearwardly of the rearward end portion of said housing between the formwork and said housing.

14. In the anchorage assembly as defined in claim **1** wherein said fixing means includes anchor housing connecting means adjacent one of the end portions of said housing and member connecting means adjacent one of the end portions of said member, said connecting means of said anchor housing and said member cooperating and forming a removable connection therebetween.

15. In the anchorage assembly as defined in claim **14** wherein said one housing end portion is its rearward end portion and said one member end portion is its forward end portion.

16. In the anchorage assembly as defined in claim **1** wherein said housing includes a forward end portion, the hollow of said housing including a longitudinal passageway extending therethrough, and sealing means disposed between the tendon and said housing for excluding concrete from entering the end of said passageway remote from the formwork.

17. In an anchorage assembly including an anchor having a hollow housing and a stressing tendon passing therethrough, said anchor including flange means attached to and extending generally laterally outwardly of said housing, said flange means fixing said anchor in concrete after setting thereof whereby said anchor is inhibited from movement in a direction inardly of the concrete, gripping means within said hollow of said housing for engaging the portion of said tendon in said housing, the improvement comprising first means for supporting said housing on a formwork and for forming a cavity in the concrete, said first means including a member extending generally longitudinally of the tendon for supportingly connecting between said housing and a formwork, fixing means for attaching said member to said housing, said first means further including a spacer for forming a cavity in concrete between said housing and formwork, said member fixing the relative position of said anchor housing to the formwork and adapted to extend through said cavity, said anchor housing including a forward end portion, the hollow of said housing including a longitudinal passageway extending therethrough, and sealing means disposed between the tendon and said housing for excluding concrete from entering the end of said passageway remote from the formwork, said selaing means including the sheathing of the stressing tendon which enters into said passageway and seals between said housing and the tendon to prevent ingress of concrete into said passageway end.

18. In an anchorage assembly including an anchor having a hollow housing and a stressing tendon passing therethrough, said anchor including flange means attached to and extending generally laterally outwardly of said housing, said flange means fixing said anchor in concrete after setting thereof whereby said anchor is inhibited from movement in a direction inwardly of the

concrete, gripping means within sai hollow of said housing for engaging the portion of said tendon in said housing, the improvement comprising first means for supporting said housing on a formwork and for forming a cavity in the concrete, said first means including a member extending generally longitudinally of the tendon for supportingly connecting between said housing and a formwork, fixing means for attaching said member to said housing, said first means further including a spacer for forming a cavity in concrete between said housing and formwork, said member fixing the relative position of said anchor housing to the formwork and adapted to extend through said cavity, said anchor housing including a forward end portion, the hollow of said housing including a longitudinal passageway extending therethrough, and sealing means disposed between the tendon and said housing for excluding concrete from entering the end of said passageway remote from the formwork, said sealing means including a flexible and resilient bushing positioned within said end of said passageway about the tendon, said bushing being frictionally engaged and sealing between said housing and the tendon.

19. In an anchorage assembly including an anchor having a hollow continuous and leakproof housing with an inner slanted wall on which gripping means are supportable, said anchor including flange means attached to and extending generally laterally outwardly of said housing for embedment into set concrete, said gripping means being engageable with a stressing tendon passing through said housing, the improvement comprising means for supporting said housing and for forming a cavity in the set concrete, said means including a unitary elongated support member attached to said housing, said member fixing the relative position of said housing to a formwork during pouring of concrete about said housing, said housing including connecting means for attachment of said member, said member including connecting means for attachment of said housing, said connecting means of said housing and said member being engageable and disengageable upon relative rotation of said housing and said member and forming a detachable connection therebetween, said housing including a cavity therein, said housing connecting means including means extending inwardly of the wall forming said cavity of said housing, said member connecting means including an outwardly directed means adapted to be engaged and retained within said cavity by said housing connecting means, said means for supporting said housing and for forming a cavity including a spacer sandwiched between said housing and the formwork for forming said cavity, said member being disconnected from said housing after setting of concrete about said housing.

20. In an anchorage assembly including an anchor having a hollow housing with an inner slanted wall on which gripping means are supportable, said gripping means being engageable with a stressing tendon passing through said housing, the improvement comprising a member attached to said housing, said member fixing the relative position of said anchor housing to a formwork during pouring of concrete about said housing, said member housing including connecting means for attachment of said member, said number including connecting means for attaching of said housing, said connecting means of said housing and said member being engageable and disengageable upon relative rotation of said housing and said member and forming a detachable connection therebetween, said housing including a cavity therein, said housing connecting means including means extending inwardly of the wall forming said cavity of said housing, said member connecting means including an outwardly directed means adapted to be engaged and retained within said cavity by said housing connecting means, said member being disconnected from said housing after setting of concrete about said housing, said means extending inwardly of said wall forming said cavity including a shoulder and said outwardly directed means including a shoulder, said shoulder of said member being disposed inwardly of said cavity with respect to said shoulder of said housing.

21. In the anchorage assembly as defined in claim **20** wherein said means extending inwardly of said wall forming said cavity includes another shoulder spaced from said housing shoulder and extending inwardly of said cavity wall, said outwardly directed means includes another outwardly directed shoulder spaced from said member shoulder and adapted to be engaged and retained within saiid cavity by said other housing shoulder.

22. In an anchorage assembly including an anchor having a hollow continuous and leakproof housing with laterally extending flange means for embedment in set concrete and gripping means therein engageable with a stressing tendon passing therethrough, the improvement comprising a means for forming a cavity and for supporting said housing including a unitary and elongated member releasably and rotatably detached and attached to said housing, said member supporting said anchor housing and fixing the relative position of said anchor housing to a formwork, said member being hollow and surrounding the tendon between said anchor housing and the formwork, said means including means for excluding concrete from between said housing and the formwork and for forming a cavity in concrete after pouring and setting thereof between the formwork and said anchor housing, said means being removed from said housing after setting of concrete about said housing.

23. In an anchorage assembly including an anchor having a hollow housing and gripping means therein engageable with a stressing tendon passing therethrough, the improvement comprising a member releasably and rotatably detached and attached to said housing, said member supporting said anchor housing and fixing the relative position of said anchor housing to a formwork, said member being hollow and surrounding the tendon between said anchor housing and the formwork, said member including means for forming a cavity in concrete after pouring and setting thereof between the formwork and said anchor housing, said member being removed from said housing after setting of concrete about said housing, said member being flexible and resilient, said member having opposite ends and a slot extending between said ends and communicating with the hollow therethrough, said slot being enlargeable in a direction transversely of the tendon to permit the tendon to pass through said slot.

24. In an anchorage assembly including an anchor having a hollow, continuous and leakproof housing and a stressing tendon passing therethrough, said anchor including flange means attached to and extending generally laterally outwardly of said housing, said flange

means fixing said anchor in concrete after setting thereof whereby said anchor is inhibited from movement in a direction inwardly of the concrete, gripping means within said hollow of said housing for engaging the portion of said tendon in said housing, the improvement comprising a unitary member, said member supporting said anchor housing and fixing the relative position of said anchor housing to a formwork, said member being elongated and including an end and a longitudinal passageway opening through said end, means for attaching said end of said member to said housing with the tendon entering said passageway, said member extending from its said end through an opening in the formwork, and adjustable means for removably attaching said member to the formwork and for spacing said housing a predetermined distance from the formwork.

25. In the anchorage assembly as defined in claim **24** further comprising a cavity forming spacer surrounding said member and disposed between said anchor housing and the formwork for forming a cavity in concrete after pouring and setting thereof between the formwork and said anchor housing.

26. In an anchorage assembly including an anchor having a hollow housing and a stressing tendon passing therethrough, said anchor including flange means attached to and extending generally laterally outwardly of said housing, said flange means fixing said anchor in concrete after setting thereof whereby said anchor is inhibited from movement in a direction inwardly of the concrete, gripping means within said hollow of said houding for engaging the portion of said tendon in said housing, the improvement comprising a member, said member supporting said anchor housing and fixing the relative position of said anchor housing to a formwork, said member being elongated and including an end and a longitudinal passageway opening through said end, means for attaching said end of said member to said housing with the tendon entering said passageway, said member extending from its said end through an opening in the formwork, and means for removably attaching said member to the formwork, said member including another end extending outwardly of the formwork, said means for removably attaching said member to the formwork being disposed on said other member end.

27. In an anchorage assembly including an anchor having an elongated, hollow, continuous and leakproof housing, said housing having forward and rearward end portions, gripping means disposable within said hollow housing for engaging a stressing tendon passing therethrough, flange means extending generally outwardly from said housing for embedment in set concrete, and connecting means extending inwardly of the wall forming the hollow of said housing, an elongated member for supporting said housing on a formwork and having connecting means extending outwardly therefrom said housing connecting means temporarily engaging sand retaining said member connecting means within said hollow, said member being relatively rotatable with respect to said housing and detachable therefrom upon proper rotation and after pouring and setting of concrete about said housing, means for sealing said housing front end portion to the stressing tendon, and means for sealing said housing rearward end portion to the formwork.

28. In the anchorage assembly as defined in claim **27** wherein said housing connecting means includes an inwardly directed shoulder and wherein said member connecting means includes an outwardly directed shoulder.

29. In the anchorage assembly as defined in claim **27** wherein each of said housing connecting means and member connecting means includes a pair of spaced shoulders.

30. In an anchorage assembly including an anchor having a hollow, continuous and leakproof housing with an outer end adapted to be disposed toward a formwork for concrete to be cast around said anchor, said anchor including flange means attached to and extending generally laterally outwardly of said housing, said flange means fixing said anchor in concrete after setting thereof whereby said anchor is inhibited from movement in a direction inwardly of the concrete, gripping means within said hollow of said housing for engaging the portion of said tendon in said housing, the improvement comprising a cavity forming and anchor positioning means including an outer surface to define a cavity in the concrete after pouring and setting thereof which extends from the inner surface of the formwork to said outer end of said housing, said anchor forming and anchor positioning means including an elongated unitary member extending within said outer surface and having one end portion supporting said anchor and another end portion spaced from said outer end of said housing and supported by the formwork.

31. In the anchorage assembly as defined in claim **30** wherein said member is hollow and surrounds a stressing tendon passing through said hollow housing between said housing outer end and the formwork.

32. In the anchorage assembly as defined in claim **30** wherein said cavity forming and anchor positioning means includes a cavity forming spacer surrounding said member, said spacer including said outer surface between said housing outer end and the formwork.

33. In the anchorage assembly as defined in claim **30** further comprising means engaged on said member for attaching said member to the formwork.

34. In the anchorage assembly as defined in claim **30** further comprising means engaged on said member for releasably attaching said member to the formwork.

35. In the anchorage assembly as defined in claim **34** wherein said member includes an end portion extending through an opening in the formwork, said means engaged on said member being disposed on said end portion outwardly of the formwork.

36. In the anchorage assembly as defined in claim **30** further comprising means for attaching said member to said housing.

37. In the anchorage assembly as defined in claim **30** further comprising means for releasably attaching said member to said housing.

38. In the anchorage assembly as defined in claim **37** wherein said means for releasably attaching includes an inwardly directed means within the hollow of said housing and an outwardly directed means of said member, said inwardly directed means and outwardly directed means being movable from a connecting position inhibiting separation of said member and housing to a non-connecting position whereby said member and housing may be separated.

39. In the anchorage assembly as defined in claim **38** wherein each said inwardly and outwardly directed means includes a shoulder.

40. In the anchorage assembly as defined in claim **30** further comprising a restraining member engaged on said elongated member for urging said anchor housing toward the formwork, and spacer means interposed in sealing relationship between said housing outer end and the formwork, said spacer means including said outer surface between said housing outer end and the formwork.

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