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(54) COLD HEADING FORMED WEDGE FOR USE IN POST TENSIONING CONCRETE

KALTSTAUCHGEFORMTER KEIL ZUR VERWENDUNG IN VORGESPANNTEM BETON

COIN FORMÉ DE MATRIÇAGE À FROID DESTINÉ À ÊTRE UTILISÉ EN BÉTON POST-CONTRAINTE

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(56) References cited:
EP-A1- 2 151 289
DE-C- 975 906
JP-A- 2006 255 778
US-A- 4 362 421

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Description

Technical Field/Field of the Disclosure

[0001] The present disclosure relates generally to post-tensioned, pre-stressed concrete construction. The present disclosure relates specifically to wedges for anchors for use therein.

Background of the Disclosure

[0002] Many structures are built using concrete, including, for instance, buildings, parking structures, apartments, condominiums, hotels, mixed-use buildings, casinos, hospitals, medical buildings, government buildings, research/academic institutions, industrial buildings, malls, bridges, pavement, tanks, reservoirs, silos, foundations, sports courts, and other structures.

[0003] Pre-stressed concrete is structural concrete in which internal stresses are introduced to reduce potential tensile stresses in the concrete resulting from applied loads. This can be accomplished by two methods-post-tensioned pre-stressing and pre-tensioned pre-stressing. When post-tensioning concrete, the pre-stressing assembly is tensioned after the concrete has attained a specified strength. The pre-stressing assembly, commonly known as a tendon, may include for example and without limitation, anchorages, one or more strands, and sheathes or ducts. The strand is tensioned between anchors which are embedded in the concrete once the concrete has hardened. The strand may be formed from a metal or composite or any suitable material exhibiting tensile strength which can be elongated including, for example and without limitation, reinforcing steel, single wire cable, or multi-wire cable. The strand is typically fixedly coupled to a fixed anchorage positioned at one end of the tendon, the so-called "fixed end", and is adapted to be stressed at the other anchor, the "stressing end" of the tendon. The strand is generally held to each anchor by one or more wedges. Typically, anchors include a tapered recess which, when the strand is placed under tension, cause the wedges to further engage the strand. Wedges are typically made of metal.

[0004] EP2151289 discloses a method involves separating a blank from a bundle of wire by scissors, and planar dipping of the blank front faces by setting. The method involves combining cup impact extrusion, punching, hollow backward pressing, forming a circumferential ring groove by tossing and reducing rolling edges. The wire is a steel wire.

[0005] US4362421 discloses an anchor for use in the post-tensioning of prestressed concrete, including an anchor case having a longitudinally tapering outer wall surface and a tapered longitudinal bore for receiving a chuck comprising wedge segments which are in gripping engagement with a tendon passing therebetween. The anchor case and chuck are approximately the same length, and the anchor case is cold forged with the top end thereof folded inwardly to effect greater thickness at that point, which structure, in combination with a dome-shape thrust plate extending outwardly from the outer periphery of the anchor case proximate the folded portion thereof, contains the hoop forces exerted on the anchor case by the chuck.

Summary

[0006] The present disclosure provides for a method for forming a wedge for post tensioning concrete, according to the subject-matter of claim 1.

[0007] The present disclosure further provides for dependent methods according to the depending claims.

Brief Description of the Drawings

[0008] The present disclosure is best understood from the following detailed description when read with the accompanying figures. It is emphasized that, in accordance with the standard practice in the industry, various features are not drawn to scale. In fact, the dimensions of the various features may be arbitrarily increased or reduced for clarity of discussion.

FIG. 1 depicts a cross section of an anchor having a wedge consistent with at least one embodiment of the present disclosure.

FIG. 2 depicts a block diagram of a cold heading procedure for forming wedges consistent with at least one embodiment of the present disclosure.

FIGS. 3A-D depict an overview of a cold heading process for forming wedges consistent with at least one embodiment of the present disclosure.

Detailed Description

[0009] It is to be understood that the following disclosure provides many different embodiments, or examples, for implementing different features of various embodiments. Specific examples of components and arrangements are described below to simplify the present disclosure. These are, of course, merely examples and are not intended to be limiting. In addition, the present disclosure may repeat reference numerals and/or letters in the various examples. This repetition is for the purpose of simplicity and clarity and does not in itself dictate a relationship between the various embodiments and/or configurations discussed.

[0010] FIG. 1 depicts anchor 10 for use in post tensioning concrete. Anchor 10 is adapted to receive and couple to strand 12 of tendon 14. During installation, strand 12 may be threaded through anchor 10. Strand 12 may be, for example and without limitation, mono-wire cable or multi-wire cable. For the purposes of this disclosure, the axis parallel with the length of strand 12 will be referred

to as the longitudinal axis of strand 12. Anchor 10 may include anchor body 16 adapted to retain the position of anchor 10 when positioned in formed concrete.

[0011] Anchor 10 may couple to strand 12 by the use of one or more wedges 100. Wedges 100 may be substantially wedge shaped and adapted to fit into a tapered recess 18 formed in anchor body 16. During use, wedges 100 may be installed to the strand in a direction perpendicular to the longitudinal axis of the strand. Tension on strand 12 may cause wedges 100 to move into tapered recess 18, applying a gripping force on strand 12.

[0012] In some embodiments, wedges 100 may be formed by cold heading. FIG. 2 depicts a block diagram of a cold heading process. Wire 101 is provided on spool 103. Wire 101 is fed by one or more drive wheels (not shown) into cold heading apparatus 105. In some embodiments, cold heading apparatus 105 may include straightening apparatus 107 which may include a plurality of rollers adapted to straighten wire 101 as it enters cold heading apparatus 105. Wire 101 may be fed to forming dies 109. Forming dies 109 reshape a portion of wire 101 progressively into the final form of one or more wedge blanks 113. At some point in the cold heading operation, a portion of wire 101 is separated 111 from the rest of wire 101, separating the one or more formed wedge blanks 113.

[0013] As depicted in FIGS. 3A-D, forming dies 109a-f may be utilized to progressively reshape a portion of wire 101 by cold heading. FIGS. 3A-D depict the cold heading operation as a 3-step operation, but one having ordinary skill in the art with the benefit of this disclosure will understand that any number of operations may be undertaken to cold head wedge blanks 113. The following discussion is merely exemplary of a cold heading operation consistent with at least one embodiment of the present disclosure.

[0014] As depicted in FIG. 3A, wire 101 is fed through forming die 109a. Wire portion 115 is formed between forming die 109a and 109b to initially reshape wire portion 115. In this embodiment, a portion of wire 101 is separated from wire 101 at this stage by, for example, shear cutter 117 to be formed into wedge blank 113. As depicted in FIG. 3B, forming dies 109c, 109d further refine the shape of wire portion 115. In this embodiment, two wedge blanks 113 are formed simultaneously from wire portion 115. One having ordinary skill in the art with the benefit of this disclosure will understand that any number of wedge blanks 113 may be formed from wire portion 115. As depicted in FIG. 3C, forming dies 109e, 109f further refine the shape of wedge blanks 113 into the final cold headed form shown in FIG. 3D. As understood by one having ordinary skill in the art with the benefit of this disclosure, forming dies 109a-f may operate by stamping, swaging, punching, forging, extruding, upsetting, or a combination thereof.

[0015] In some embodiments, wedge blanks 113 may emerge from the cold heading process in a final form requiring no additional treatment. In some embodiments, wedge blanks 113 may be further processed as shown in FIG. 2 as further treatment 119. For example, in some embodiments, wedge blanks 113 may be tumbled or otherwise polished to improve their surface finish. In some embodiments, wedge blanks 113 may be given a surface treatment or may be heat treated, hardened, or tempered. In some embodiments, wedge blanks 113 may be further machined to, for example and without limitation, add grooves.

[0016] The foregoing outlines features of several embodiments so that a person of ordinary skill in the art may better understand the aspects of the present disclosure. Such features may be replaced by any one of numerous equivalent alternatives, only some of which are disclosed herein. One of ordinary skill in the art should appreciate that they may readily use the present disclosure as a basis for designing or modifying other processes and structures for carrying out the same purposes and/or achieving the same advantages of the embodiments introduced herein. One of ordinary skill in the art should also realize that such equivalent constructions do not depart from the scope of the present disclosure and that they may make various changes, substitutions, and alterations herein without departing from the scope of the appended claims.

[0017] The present invention will now be described with reference to the following claims.

Claims

1. A method for forming a wedge (100) for post tensioning concrete comprising:

   providing a wire (101);
   feeding a portion of the wire (101) into a cold heading apparatus;
   cold heading a portion of the wire (101) to form at least one wedge blank (113);
   and
   finishing the wedge blank (113) to form the wedge (100);
   wherein cold heading a portion of the wire (101) to form at least one wedge blank (113) comprises:

      feeding the portion of the wire (101) between a first and second forming die (109a, 109b);
      reshaping the portion of the wire (101) by the first and second forming die (109a, 109b); and
      separating the reshaped portion of the wire from the wire (101) to form the at least one wedge blank (113).

2. The method of claim 1, wherein reshaping the portion of the wire (101) by the first and second forming die

(109a, 109b) comprises one or more of stamping, swaging, punching, forging, extruding, or upsetting the portion of the wire (101).

3. The method of claim 1 or claim 2, further comprising further reshaping the portion of the wire (101) by a third and fourth forming die (109c, 109d).

4. The method of any one of claims 1 to 3, wherein finishing the wedge blank (113) to form the wedge (100) comprises one or more of tumbling, polishing, heat treating, hardening, tempering, grooving, or surface treating the wedge blank (113).

5. The method of any one of claims 1 to 4, wherein the process of feeding the wire (101) to the cold heading apparatus is performed by one or more drive wheels; optionally, wherein the cold heading apparatus further includes a straightening apparatus, the straightening apparatus including a plurality of rollers.

6. The method of any one of claims 1 to 5, wherein two wedge blanks (113) are formed simultaneously.

7. The method of any one of claims 1 to 6, further comprising machining the wedge blanks (113) to form grooves.

8. The method according to claim 1, further comprising:

providing an anchor (10) for post tensioning concrete;
threading a strand (12) through the anchor (10); and
positioning the wedge (100) on the strand (12).

9. The method of claim 8, wherein positioning the wedge (100) is on the strand (12) is in a direction perpendicular to the longitudinal axis of the strand (12).

10. The method of claim 8 or 9, wherein reshaping the portion of the wire (101) by the first and second forming die (109a, 109b) comprises one or more of stamping, swaging, punching, forging, extruding, or upsetting the portion of the wire (101); optionally, further comprising further reshaping the portion of the wire (101) by a third and fourth forming die (109c, 109d).

11. The method of any one of claims 8 to 10, wherein finishing the wedge blank (113) to form the wedge (100) comprises one or more of tumbling, polishing, heat treating, hardening, tempering, grooving, or surface treating the wedge blank (113).

12. The method of any one of claims 8 to 11, further comprising moving the wedge (100) into a tapered recess; optionally, further comprising applying a gripping force using the wedges (100) on the strand (12).

13. The method of any one of claims 9 to 12, wherein the wedges (100) have grooves.

Patentansprüche

1. Verfahren zum Formen eines Keils (100) für Vorspannbeton, umfassend:

Bereitstellen eines Drahtes (101);
Speisen eines Abschnitts des Drahtes (101) in eine Kaltstauchvorrichtung;
Kaltstauchen eines Abschnitts des Drahtes (101), um zumindest einen Keilrohling (113) zu formen;
und
Fertigstellen des Keilrohlings (113), um den Keil (100) zu formen;
wobei das Kaltstauchen eines Abschnitts des Drahtes (101), um zumindest einen Keilrohling (113) zu formen, umfasst:

Speisen des Abschnitts des Drahtes (101) zwischen ein erstes und zweites Umformwerkzeug (109a, 109b);
Umformen des Drahtabschnitts (101) durch das erste und zweite Umformwerkzeug (109a, 109b); und
Trennen des umgeformten Abschnitts des Drahtes vom Draht (101), um zumindest einen Keilrohling (113) zu formen.

2. Verfahren nach Anspruch 1, wobei das Umformen des Drahtabschnitts (101) durch das erste und zweite Umformwerkzeug (109a, 109b) eins oder mehrere von Stempeln, Kalthämmern, Stanzen, Schmieden, Extrudieren oder Stauchen des Drahtabschnitts (101) umfasst.

3. Verfahren nach Anspruch 1 oder Anspruch 2, das ferner das Umformen des Drahtabschnitts (101) durch ein drittes und viertes Umformwerkzeug (109c, 109d) umfasst.

4. Verfahren nach einem der Ansprüche 1 bis 3, wobei das Fertigstellen des Keilrohlings (113) zum Formen des Keils (100) eins oder mehrere von Putzen in Trommeln, Polieren, Wärmebehandlung, Härtung, Glühen, Riffelung oder Oberflächenbehandlung des Keilrohlings (113) umfasst.

5. Verfahren nach einem der Ansprüche 1 bis 4, wobei der Prozess der Speisung des Drahtes (101) zur Kaltstauchvorrichtung von einem oder mehreren An-

triebsrädern durchgeführt wird; optional, wobei die Kaltstauchvorrichtung ferner einen Richtapparat einschließt, wobei der Richtapparat eine Vielzahl von Rollen einschließt.

6. Verfahren nach einem der Ansprüche 1 bis 5, wobei die zwei Keilrohlinge (113) gleichzeitig geformt werden.

7. Verfahren nach einem der Ansprüche 1 bis 6, das ferner die Bearbeitung der Keilrohlinge (113) zum Formen von Nuten umfasst.

8. Verfahren nach Anspruch 1, ferner umfassend:

Bereitstellen eines Ankers (10) für vorgespannten Beton;
Fädeln eines Drahtes (12) durch den Anker (10); und
Positionieren des Keils (100) auf dem Draht (12).

9. Verfahren nach Anspruch 8, wobei das Positionieren des Keils (100) auf dem Draht (12) in einer Richtung senkrecht zur Längsachse des Drahtes (12) geschieht.

10. Verfahren nach Anspruch 8 oder 9, wobei das Umformen des Drahtabschnitts (101) durch das erste und zweite Umformwerkzeug (109a, 109b) eins oder mehrere von Stempeln, Kalthämmern, Stanzen, Schmieden, Extrudieren oder Stauchen des Drahtabschnitts (101) umfasst; optional ferner das weitere Umformen des Drahtabschnitts (101) durch ein drittes und viertes Umformwerkzeug (109c, 109d) umfasst.

11. Verfahren nach einem der Ansprüche 8 bis 10, wobei das Fertigstellen des Keilrohlings (113) zum Formen des Keils (100) eins oder mehrere von Putzen in Trommeln, Polieren, Wärmebehandlung, Härtung, Glühen, Riffelung oder Oberflächenbehandlung des Keilrohlings (113) umfasst.

12. Verfahren nach einem der Ansprüche 8 bis 11, das ferner das Bewegen des Keils (100) in eine konische Vertiefung umfasst; optional, ferner die Anwendung einer Greifkraft unter Verwendung der Keile (100) am Draht (12) umfasst.

13. Verfahren nach einem der Ansprüche 9 bis 12, wobei die Keile (100) Nuten aufweisen.

Revendications

1. Un procédé pour former un coin (100) pour la post-tension du béton, comprenant les étapes consistant à :

fournir un câble (101) ;
amener une partie du câble (101) dans un appareil de matriçage à froid ;
matricer à froid une partie du câble (101) pour former au moins une ébauche de coin (113) ; et
procéder au finissage de l'ébauche de coin (113) pour former le coin (100) ;
dans lequel le matriçage à froid d'une partie du câble (101) pour former au moins une ébauche de coin (113) comprend les étapes consistant à :

amener la partie du câble (101) entre une première et une deuxième matrices de formage (109a, 109b) ;
reformer la partie du câble (101) par les première et deuxième matrices de formage (109a, 109b) ; et
séparer la partie reformée du câble et le câble (101) pour former la au moins une ébauche de coin (113).

2. Le procédé de la revendication 1, dans lequel le reformage de la partie du câble (101) par les première et deuxième matrices de formage (109a, 109b) comprend l'une ou plusieurs des opérations d'estampage, de sertissage, de poinçonnage, de forgeage, d'extrusion ou de refoulement de la partie du câble (101).

3. Le procédé de la revendication 1 ou de la revendication 2, comprenant en sus le reformage supplémentaire de la partie du câble (101) par une troisième et une quatrième matrices de formage (109c, 109d).

4. Le procédé d'une quelconque des revendications 1 à 3, dans lequel le finissage de l'ébauche de coin (113) pour former le coin (100) comprend l'une ou plusieurs des opérations de tonnelage, polissage, traitement thermique, durcissage, tempérage, rainurage ou traitement de surface de l'ébauche de coin (113).

5. Le procédé d'une quelconque des revendications 1 à 4, dans lequel l'opération d'alimentation du câble (101) dans l'appareil de matriçage à froid est exécutée par une ou plusieurs roues d'entraînement ; éventuellement, dans lequel l'appareil de matriçage à froid comprend en sus un appareil de redressage, l'appareil de redressage comportant une pluralité de rouleaux.

6. Le procédé d'une quelconque des revendications 1 à 5, dans lequel deux ébauches de coin (113) sont formées simultanément.

7. Le procédé d'une quelconque des revendications 1 à 6, comprenant en sus l'usinage des ébauches de coin (113) pour former des rainures.

8. Le procédé selon la revendication 1, comprenant en sus les étapes consistant à :

fournir un ancrage (10) pour post-tensionner le béton ;
enfiler un toron (12) à travers l'ancrage (10) ; et
positionner le coin (100) sur le toron (12).

9. Le procédé de la revendication 8, dans lequel le placement du coin (100) sur le toron (12) est dans une direction perpendiculaire à l'axe longitudinal du toron (12).

10. Le procédé de la revendication 8 ou de la revendication 9, dans lequel le reformage de la partie du câble (101) par les première et deuxième matrices de formage (109a, 109b) comprend l'une ou plusieurs des opérations d'estampage, de sertissage, de poinçonnage, de forgeage, d'extrusion ou de refoulement de la partie du câble (101) ; éventuellement, comprenant en sus un reformage supplémentaire de la partie du câble (101) par une troisième et une quatrième matrices de formage (109c, 109d).

11. Le procédé d'une quelconque des revendications 8 à 10, dans lequel le finissage de l'ébauche de coin (113) pour former le coin (100) comprend l'une ou plusieurs des opérations de tonnelage, polissage, traitement thermique, durcissage, tempérage, rainurage ou traitement de surface de l'ébauche de coin (113).

12. Le procédé d'une quelconque des revendications 8 à 11, comprenant en sus le déplacement du coin (100) dans un renfoncement conique ; éventuellement, comprenant en sus l'application d'une force de serrage en utilisant les coins (100) sur le toron (12).

13. Le procédé d'une quelconque des revendications 9 à 12, dans lequel les coins (100) ont des rainures.

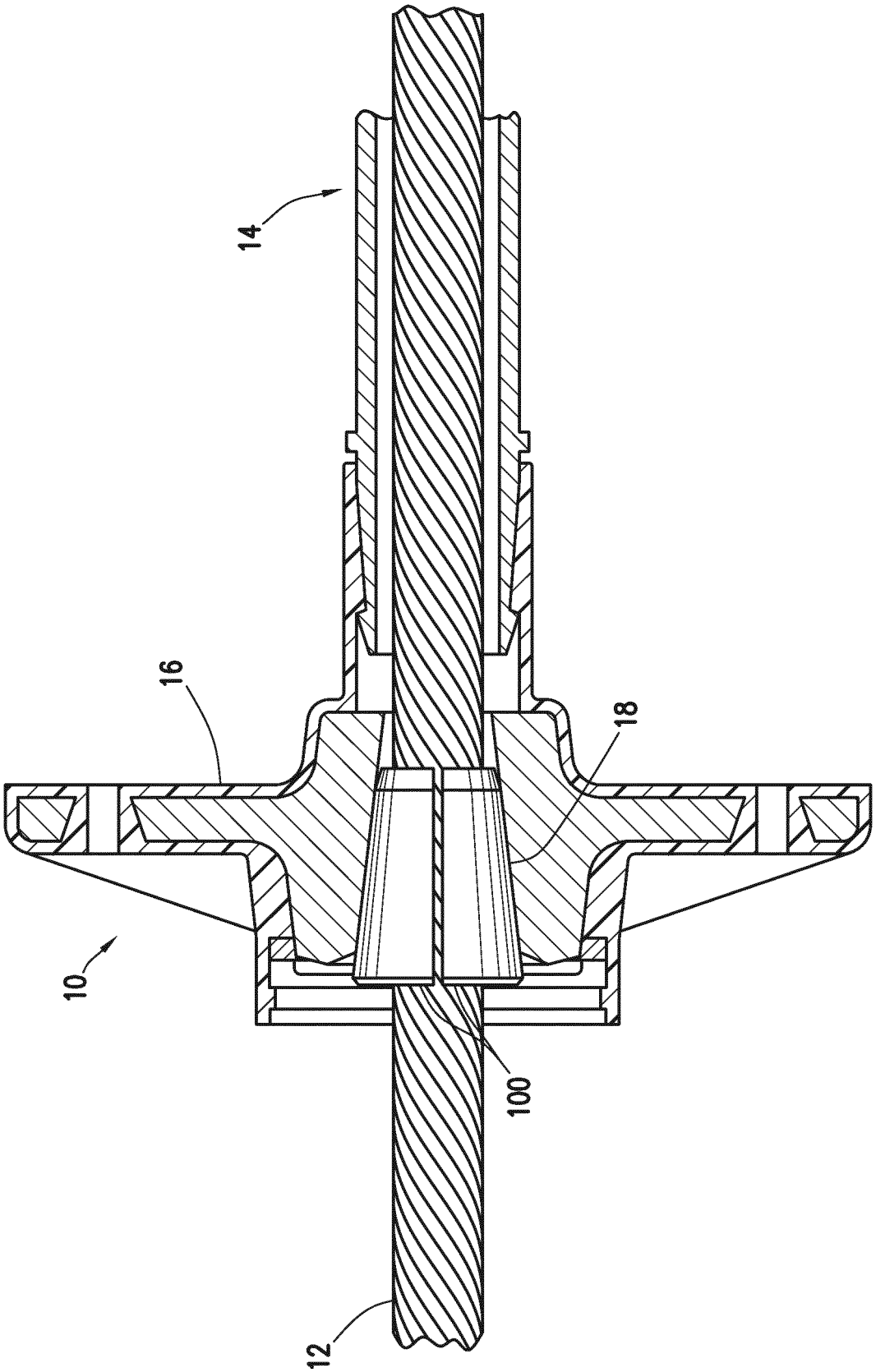


FIG. 1

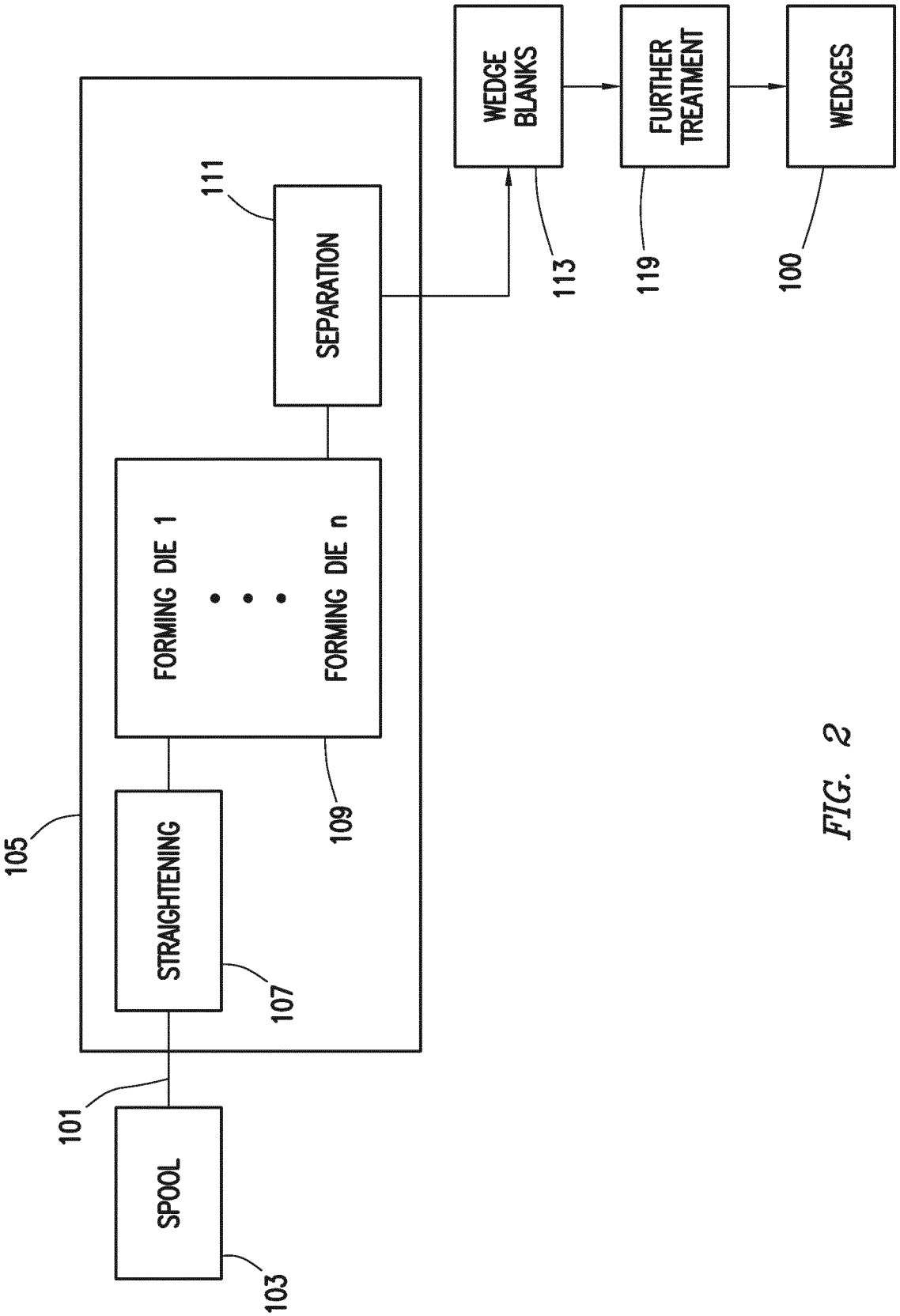

SPOOL
STRAIGHTENING
FORMING DIE 1
FORMING DIE n
SEPARATION
WEDGE BLANKS
FURTHER TREATMENT
WEDGES
101
103
105
107
109
111
113
119
100

FIG. 2

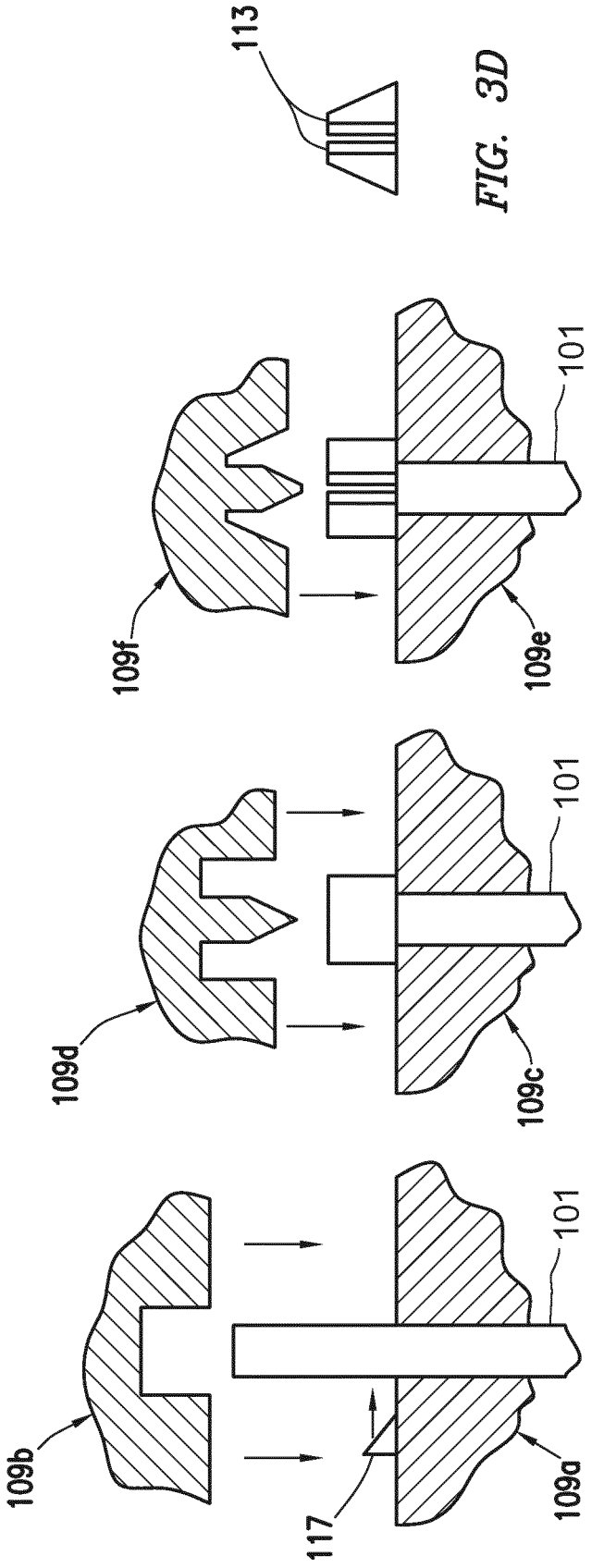


FIG. 3A

FIG. 3B

FIG. 3C

FIG. 3D

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2151289 A **[0004]**
- US 4362421 A **[0005]**