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(54) **MOLD PIN FOR MANUFACTURING TUBE YOKE**

(57) The present invention relates to a mold pin for manufacturing a tube yoke, capable of rapidly manufacturing a tube yoke provided with a spline on a tube part through a forging step while preventing distortion involving a twisted shape of the spline. To this end, the mold pin for manufacturing the tube yoke, according to the present invention, is provided with a spline part on the outer circumferential surface thereof to form the spline on the inside of the tube part of the tube yoke comprising the tube part and a yoke part, wherein a land part protruding along the outer circumferential direction is formed on the spline part corresponding to one side in the length-wise direction of the mold pin.

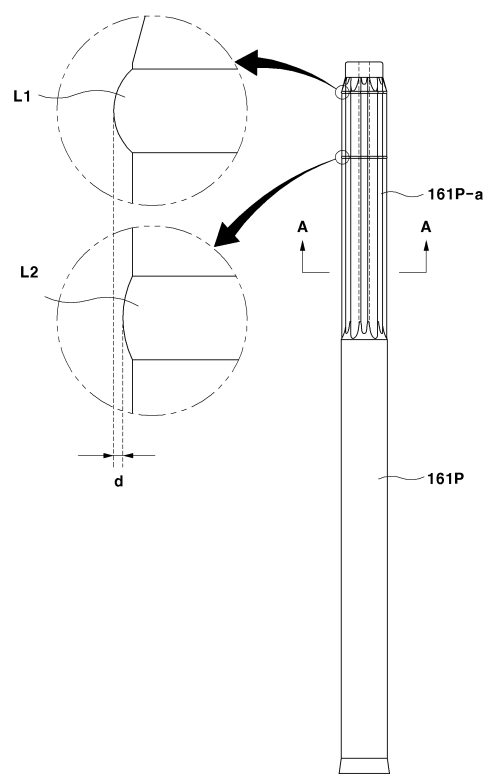


FIG. 12

Description**TECHNICAL FIELD**

[0001] The present invention relates to a mold pin for manufacturing a tube yoke, and more particularly, to a mold pin for manufacturing a tube yoke, which is capable of rapidly manufacturing a tube yoke provided with a spline on a tube part through a forging step while preventing distortion involving a twisted shape of the spline.

BACKGROUND ART

[0002] A general yoke is provided to smoothly transmit a power of a driving shaft to a driven shaft when a driven shaft is not disposed on the same line with respect to a rotating main shaft such as a propulsion shaft transmitting a power of an engine or a steering of a vehicle.

[0003] FIG. 1 is a perspective view of a typical tube yoke. The tube yoke includes a yoke part 2 and a shaft 3 coupled to a lower portion of the yoke part 2.

[0004] In case of the typical tube yoke, the tube yoke is manufactured such that the yoke part 2 and the shaft 3 are separately manufactured, and then the lower portion of the yoke part 2 is welded to an upper portion of the shaft 3.

[0005] However, as described above, the typical tube yoke, which is manufactured by welding the yoke part to the shaft, has a limitation in that a knuckle part and a shaft are manufactured in a separate device. Due to the limitation, costs for facilities may increase, deformation such as distortion of the knuckle part or the shaft may be generated by heat during welding, and furthermore, the tube yoke is weak during usage because a welded portion is vulnerable.

[0006] To resolve the above-described limitation, a tube yoke in which the yoke part and the shaft part are integrated with each other has been disclosed.

[0007] However, in case of the tube yoke in which the yoke part and the shaft part are integrated with each other, additional steps such as calibration after the spline is formed are required because the spline is difficult to be formed on an inner surface of the tube yoke.

[0008] Also, as described above, when the tube yoke in which the yoke part and the shaft part are integrated with each other is manufactured through a forging step and the spline is formed through a separate processing step due to the difficulty of spline formation, a manufacturing time may extremely increase and manufacturing costs also may increase.

(RELATED ART DOCUMENTS)

[0009] Patent Registration No. 10-0767105 (Registration date October 08 2007)

DISCLOSURE OF THE INVENTION**TECHNICAL PROBLEM**

[0010] The present invention provides a mold pin for manufacturing a tube yoke, which is capable of rapidly manufacturing a tube yoke provided with a spline on a tube part through a forging step while preventing distortion involving a twisted shape of the spline.

TECHNICAL SOLUTION

[0011] An embodiment of the present invention provides a mold pin for manufacturing a tube yoke provided with a spline part on an outer circumferential surface thereof in order to mold a spline inside a tube part of a tube yoke including a tube part and a yoke part. Here, a land part protruding along an outer circumferential direction is formed on the spline part corresponding to one side of a lengthwise direction of the mold pin.

[0012] In an embodiment, the land part may include a first land part formed on one side end of the lengthwise direction of the mold pin and a second land part formed at a position spaced toward the other side from the first land part.

[0013] In an embodiment, the first land part may have a protruding height greater than the second land part.

ADVANTAGEOUS EFFECTS

[0014] As described above, the present invention has an advantage in that the tube yoke provided with the spline on the tube part through a forging step may be rapidly manufactured.

[0015] The present invention also has an advantage in that the distortion involving the twisted shape of the spline of the tube part may be prevented.

BRIEF DESCRIPTION OF THE DRAWINGS**[0016]**

FIG. 1 is a perspective view illustrating a typical tube yoke.

FIG. 2 is a view illustrating a tube yoke manufacturing device according to an embodiment of the present invention.

FIG. 3 is a view illustrating a central groove molding die of the tube yoke manufacturing device according to an embodiment of the present invention.

FIG. 4 is a view illustrating a primary backward extrusion molding die of the tube yoke manufacturing device according to an embodiment of the present invention.

FIG. 5 is a view illustrating a secondary backward extrusion molding die of the tube yoke manufacturing device according to an embodiment of the present invention.

FIG. 6 is a view illustrating a preliminary yoke molding die of the tube yoke manufacturing device according to an embodiment of the present invention. FIG. 7 is a view illustrating a yoke molding die of the tube yoke manufacturing device according to an embodiment of the present invention.

FIG. 8 is a view illustrating a spline molding die of the tube yoke manufacturing device according to an embodiment of the present invention.

FIGS. 9 to 11 are views illustrating steps of forming a spline through a spline molding die of the tube yoke manufacturing device according to an embodiment of the present invention.

FIG. 12 is a view illustrating a mold pin provided in the spline molding die of the tube yoke manufacturing device according to an embodiment of the present invention.

FIG. 13 is a cross-sectional view taken along line A-A of FIG. 12.

MODE FOR CARRYING OUT THE INVENTION

[0017] The present invention may be embodied in different forms without being out of the scope, technical idea and essential features of the present invention. The preferred embodiments should be considered in descriptive sense only and are not for purposes of limitation.

[0018] It will be understood that although the terms such as 'first' and 'second' are used herein to describe various elements, these elements should not be limited by these terms.

[0019] The terms are only used to distinguish one component from other components. For example, a first element referred to as a first element in one embodiment can be referred to as a second element in another embodiment without departing from the scope of the appended claims.

[0020] The word 'and/or' means that one or more or a combination of relevant constituent elements is possible.

[0021] It will also be understood that when an element is referred to as being "connected to" or "engaged with" another element, it can be directly connected to the other element, or intervening elements may also be present.

[0022] It will also be understood that when an element is referred to as being 'directly connected to' another element, there is no intervening elements.

[0023] In the following description, the technical terms are used only for explaining a specific exemplary embodiment while not limiting the present invention. The terms of a singular form may include plural forms unless referred to the contrary.

[0024] The meaning of 'include' or 'comprise' specifies a property, a region, a fixed number, a step, a process, an element and/or a component but does not exclude other properties, regions, fixed numbers, steps, processes, elements and/or components.

[0025] Unless terms used in the present disclosure are defined differently, the terms may be construed as mean-

ing known to those skilled in the art.

[0026] Terms such as terms that are generally used and have been in dictionaries should be construed as having meanings matched with contextual meanings in the art. In this description, unless defined clearly, terms are not ideally, excessively construed as formal meanings.

[0027] Hereinafter, embodiments disclosed in this specification is described with reference to the accompanying drawings, and the same or corresponding components are given with the same drawing number regardless of reference number, and their duplicated description will be omitted.

[0028] Moreover, detailed descriptions related to well-known functions or configurations will be ruled out in order not to unnecessarily obscure subject matters of the present invention.

[0029] As illustrated in FIG. 2, a tube yoke manufacturing device A according to an embodiment of the present invention includes: a central groove molding die 110; a primary backward extrusion molding die 120, a secondary backward extrusion molding die 130, a preliminary yoke molding die 140, a yoke molding die 150, and a spline molding die 160.

[0030] Molding is simultaneously performed by supplying a material to be molded to each of the central groove molding die 110; the primary backward extrusion molding die 120, the secondary backward extrusion molding die 130, the preliminary yoke molding die 140, the yoke molding die 150, and the spline molding die 160.

[0031] For example, a first material is supplied to the primary backward extrusion molding die 120 through a transfer device after molded in the central groove molding die 110, and, at the same time, a second material is supplied to the central groove molding die 110 together with the transfer of the first material.

[0032] Also, the first material is molded in the primary backward extrusion molding die 120 and then supplied to the secondary backward extrusion molding die 130. Here, the second material is supplied to the primary backward extrusion molding die 120 together with the transfer of the first material at the same time, and a new third material is also supplied to the central groove molding die 110 at the same time.

[0033] As described above, one material is molded while being sequentially transferred along the central groove molding die 110; the primary backward extrusion molding die 120, the secondary backward extrusion molding die 130, the preliminary yoke molding die 140, the yoke molding die 150, and the spline molding die 160, and the materials are successively supplied to be molded.

[0034] That is, the tube yoke manufacturing device is configured to simultaneously perform molding operations of the central groove molding die 110, the primary backward extrusion molding die 120, the secondary backward extrusion molding die 130, the preliminary yoke molding die 140, the yoke molding die 150, and the spline molding

die 160 and also configured to supply a plurality of materials, which are completely molded in each corresponding die, to dies in next steps by transfer devices at the same time.

[0035] As described above, since all of the molding operations are performed at once such that the materials are successively supplied, and, at the same time, the molding operations of the central groove molding die 110, the primary backward extrusion molding die 120, the secondary backward extrusion molding die 130, the preliminary yoke molding die 140, the yoke molding die 150, and the spline molding die 160 are performed, the tube yoke manufacturing device A according to an embodiment of the present invention may manufacture one finished product per one cycle operation (one time operation in which a punch is transferred to a dice to mold a material and then returned).

[0036] Hereinafter, a schematic structure of each of the central groove molding die 110, the primary backward extrusion molding die 120, the secondary backward extrusion molding die 130, the preliminary yoke molding die 140, the yoke molding die 150, and the spline molding die 160 will be described.

[0037] As illustrated in FIG. 3, the central groove molding die 110 includes: a central groove molding dice 111 to which a cut material is supplied and a punch 113 pressing one side of the material supplied to the central groove molding dice 111 to mold a central groove at one side of the material.

[0038] The central groove may be molded through a die pin 111P provided in the central groove molding dice 111.

[0039] During the one cycle operation of the central groove molding die 110, the central groove may be formed at one side of the material.

[0040] The primary backward extrusion molding die 120 is disposed next to the central groove molding die 110 as illustrated in FIG. 2. The primary backward extrusion molding die 120 includes: a primary backward extrusion molding dice 121 receiving the material, which is molded through the central groove molding die 110, through a separated transfer device (not shown); and a die pin 121P pressing the material supplied to the primary backward extrusion molding dice 121 to perform backward extrusion molding on the tube part provided with an inner diameter hole at one side of the material as illustrated in FIG. 4.

[0041] The primary backward extrusion may be performed as a punch 123 presses an upper portion of the material.

[0042] During one cycle operation of the primary backward extrusion molding die 120, the tube part provided with an inner diameter hole at one side of the material may be backward extrusion molded.

[0043] The secondary backward extrusion molding die 130 is disposed next to the primary backward extrusion molding die 120 as illustrated in FIG. 2. The secondary backward extrusion molding die 130 includes: a second-

ary backward extrusion molding dice 131 receiving the material, which is molded through the primary backward extrusion molding die 120, through a separated transfer device (not shown); and a die pin 131P inserted into the inner diameter hole of the material supplied to the secondary backward extrusion molding dice 131 to perform backward extrusion molding so that a length of the tube part increases as illustrated in FIG. 5.

[0044] The secondary backward extrusion may be performed as a punch 133 presses the upper portion of the material.

[0045] During one cycle operation of the secondary backward extrusion molding die 130, the tube part, which is formed at one side of the material, may be backward extrusion molded to increase the length thereof.

[0046] The preliminary yoke molding die 140 is disposed next to the secondary backward extrusion molding die 130 as illustrated in FIG. 2. The preliminary yoke molding die 140 includes: a preliminary yoke molding dice 141 receiving the material, which is molded through the secondary backward extrusion molding die 130, through a separated transfer device (not shown); and a punch 143 pressing the material supplied to the preliminary yoke molding dice 141 to mold a preliminary yoke part provided with a guide groove at the other side of the material as illustrated in FIG. 6.

[0047] The preliminary yoke molding dice 141 is provided with a die pin 141P inserted into the inner diameter hole.

[0048] During one cycle operation of the preliminary yoke molding die 140, a preliminary yoke part for molding a yoke part at the other side of the material may be molded.

[0049] The yoke molding die 150 is disposed next to the preliminary yoke molding die 140 as illustrated in FIG. 2. The yoke molding die 150 includes: a yoke molding dice 151 receiving the material, which is molded through the preliminary yoke molding die 140, through a separated transfer device (not shown); and a punch 153 pressing the material supplied to the yoke molding dice 151 to mold a yoke part as illustrated in FIG. 7.

[0050] The yoke molding die 150 is provided with a die pin 151P inserted into the inner diameter hole to complete a shape of the inner diameter hole.

[0051] During one cycle operation of the yoke molding die 150, the yoke part may be molded at the other side of the material.

[0052] The spline molding die 160 is disposed next to the yoke molding die 150 as illustrated in FIG. 2. The spline molding die 160 includes: a spline molding dice 161 receiving the material, which is molded through the yoke molding die 150, through a separated transfer device; and a mold pin 161P, which is provided with a spline part 161P-a on an outer circumferential surface thereof, inserted into the tube part to mold a spline SP inside the tube part as illustrated in FIG. 8.

[0053] During one cycle operation of the spline molding die 160, the spline SP may be formed inside the tube

part of the material.

[0054] When the spline molding die 160 is described in more detail, as illustrated in FIG. 9, the spline part 161P-a of the mold pin 161P has a length greater than a depth of the inner diameter hole of the tube part.

[0055] Also, the spline part 161P-a of the mold pin 161P has a cross-section in which a recessed portion and a protruding portion are alternately formed, and, in particular, a land part L1 and L2 protruding along an outer circumferential direction is formed on the spline part 161P-a corresponding to one side in the lengthwise direction of the mold pin 161P.

[0056] In detail, as illustrated in FIGS. 12 and 13, the land part L1 and L2 includes: a first land part L1 formed on one side end in the lengthwise direction of the mold pin 161P; and a second land part L2 spaced toward the other side from the first land L1. The first land part L1 has a protruding height greater than the second land part L2.

[0057] For example, when the spline SP is molded in a state in which the mold pin 161P is completely inserted into the tube part and then discharged, a portion of the material inside the tube part, to which a pressure less than a yield strength is applied, may exist, and such a portion may have a property of being restored to an original shape because an elastic area still exists. Due to the above-described reason, the spline may not be formed into a proper shape.

[0058] As the first land part L1 presses and deforms a portion, which is partially restored to the original shape because an elastic area is remained on a portion of the material inside the tube part in a process of forming the spline SP while the mold pin 161P is inserted into the tube part, in a discharge process once again, so that the spline SP is molded to have a correct size, the portion remained in the elastic area is plastically deformed.

[0059] In detail, while the mold pin 161P is inserted into the tube part, a portion of the material is restored to a diameter portion R (refer to FIG. 13) less than a protruding height of the first land part L1 after the first land part L1 passes. However, the mold pin 161 P presses the partially restored portion again in the discharge process to generate plastic deformation.

[0060] That is, in case of a structure without the first land part L1, the spline may be inappropriately formed because a portion of the material is applied with a pressure less than the yielding strength and thus elastically restored to the original shape when the mold pin 161P is inserted into the tube part and then discharged. However, as the first land part L1 is provided, deformation is applied two times to form the spline, and plastic deformation is generated over an entire area to form the proper shape of the spline SP.

[0061] The second land part L2 may serve to guide the discharge of the mold pin 161P in a state of being inserted into the spline part 161P-a formed by the first land part L1 while the mold pin 161P is inserted into the tube part and then discharged, and the shape of the spline SP may

be more properly formed by the second land part L2.

[0062] Hereinafter, a method for manufacturing a tube yoke using the above-described tube yoke manufacturing device A will be described.

[0063] The method for manufacturing a tube yoke according to an embodiment of the present invention includes a tube yoke forging molding step S100 and a spline forging molding step S200.

[0064] The tube yoke forging molding step S100 molds a tube yoke including a tube part and a yoke part by inserting a material into a dice and pressing the inserted material by a punch. For example, the tube yoke forging molding step S100 may include: a central recess molding step S110, a primary backward extrusion molding step S120, a secondary backward extrusion molding step S130, a preliminary yoke molding step S140, and a yoke molding step S150.

[0065] Firstly, the tube yoke forging molding step S100 including the central recess molding step S110, the primary backward extrusion molding step S120, the secondary backward extrusion molding step S130, the preliminary yoke molding step S140, and the yoke molding step S150 will be described.

[0066] The central recess molding step S110 molds a central groove at one side of a material by supplying a cut material to a central groove molding dice and then pressing the supplied cut material by a punch.

[0067] For example, the central recess molding step S110 may be performed through the above-described central groove molding die 110.

[0068] The primary backward extrusion molding step S120 supplies the material to the primary backward extrusion molding dice and then moves a die pin in a forward direction, thereby molding a tube part provided with an inner diameter hole at one side of the material.

[0069] For example, the primary backward extrusion molding step S120 may be performed through the above-described primary backward extrusion molding die 120.

[0070] The secondary backward extrusion molding step S130 supplies the material to the secondary backward extrusion molding dice and then moves a die pin in a forward direction, thereby molding to increase a length of the tube part at one side of the material.

[0071] For example, the secondary backward extrusion molding step S130 may be performed through the above-described secondary backward extrusion molding die 130.

[0072] The preliminary yoke molding step S140 supplies the material to the preliminary yoke molding dice and then presses the supplied material, thereby molding a preliminary yoke part provided with a guide groove at the other side of the material.

[0073] For example, the preliminary yoke molding step S140 may be performed through the above-described preliminary yoke molding die 140.

[0074] The yoke molding step S150 supplies the material to the yoke molding dice and then presses the supplied material, thereby molding a yoke part and complete-

ly molding an inner diameter hole by a die pin at the same time.

[0075] For example, the yoke molding step S150 may be performed through the above-described yoke molding die 150.

[0076] As described above, the tube yoke including the tube part and the yoke part may be molded through the tube yoke forging molding step S100 including the central recess molding step S110, the primary backward extrusion molding step S120, the secondary backward extrusion molding step S130, the preliminary yoke molding step S140, and the yoke molding step S150.

[0077] The spline forging molding step S200 is performed after the tube yoke forging molding step S200. In detail, the spline forging molding step S200 molds the spline SP inside the tube part by inserting the mold pin 161P provided with the spline part 161P-a on the outer circumferential surface into the tube part of the tube yoke.

[0078] For example, the spline forging molding step S200 may be performed through the above-described spline molding die 160.

[0079] The spline part 161P-a of the mold pin 161P has a cross-section in which a recessed portion and a protruding portion are alternately formed, and a land part L1 and L2 protruding along an outer circumferential direction is formed on the protruding portion of the spline part 161P-a corresponding to one side in the lengthwise direction of the mold pin 161P.

[0080] In particular, the land part L1 and L2 includes a first land part L1 formed on one side end in the lengthwise direction of the mold pin 161P and a second land part L2 spaced toward the other side from the first land L1. The first land part L1 has a protruding height greater than the second land part L2.

[0081] Also, the spline part 161P-a of the mold pin 161P has a length greater than a depth of the inner diameter hole of the tube part.

[0082] Since the shape of the land part L1 and L2 of the mold pin 161P and the length of the spline part 161P-a are previously described in the tube yoke manufacturing device A, detailed description will be omitted.

[0083] While the present invention has been particularly shown and described with reference to the accompanying drawings according to exemplary embodiments, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

Claims

1. A mold pin for manufacturing a tube yoke provided with a spline part on an outer circumferential surface thereof in order to mold a spline inside a tube part of a tube yoke comprising a tube part and a yoke part, wherein a land part protruding along an outer circumferential direction is formed on the spline part

corresponding to one side of a lengthwise direction of the mold pin.

2. The mold pin of claim 1, wherein the land part comprises a first land part formed on one side end of the lengthwise direction of the mold pin and a second land part formed at a position spaced toward the other side from the first land part.
3. The mold pin of claim 2, wherein the first land part has a protruding height greater than the second land part.

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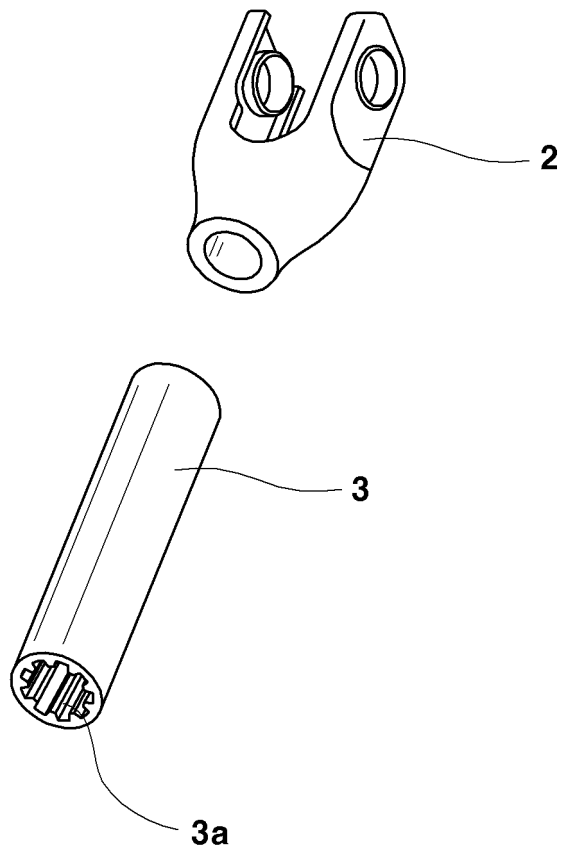


FIG. 1

"A"

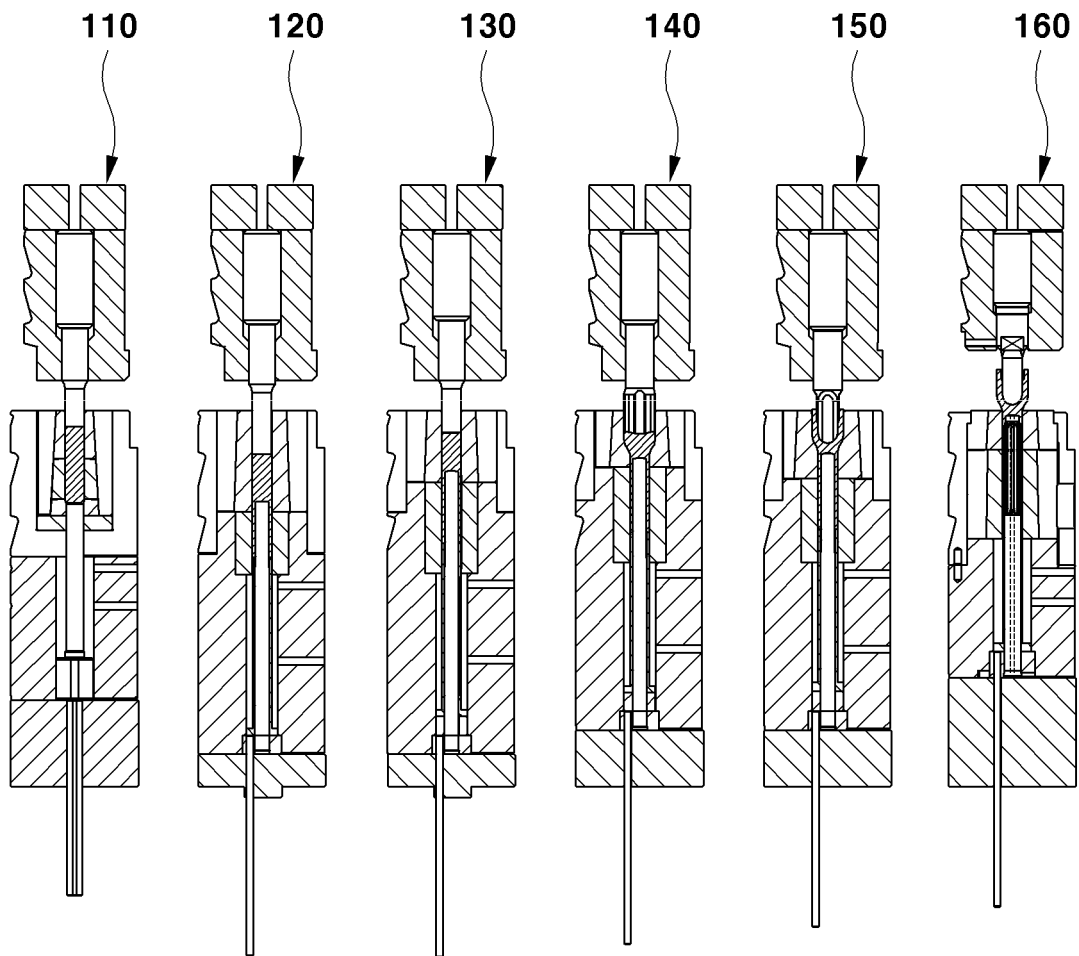


FIG. 2

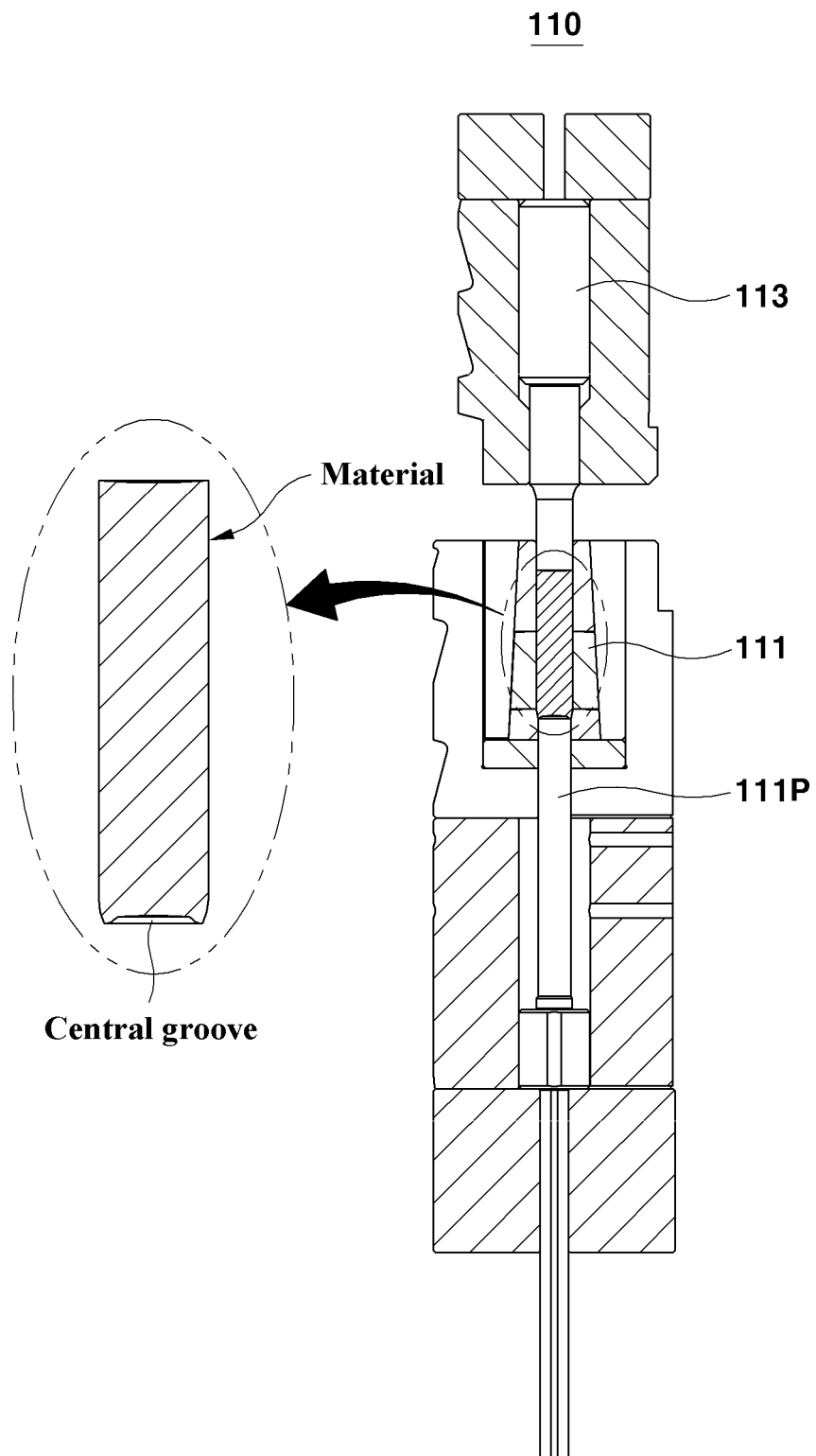


FIG. 3

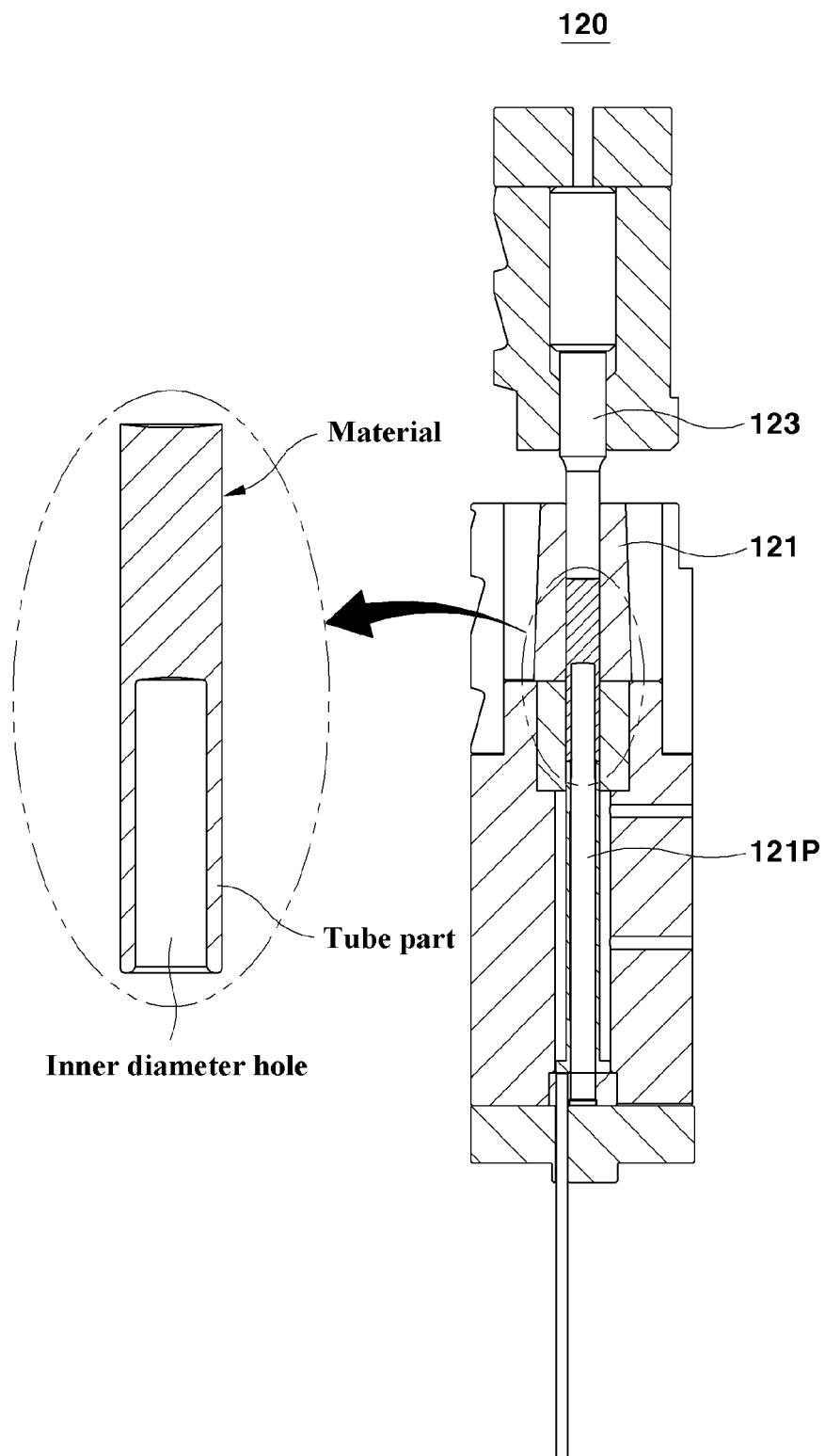


FIG. 4

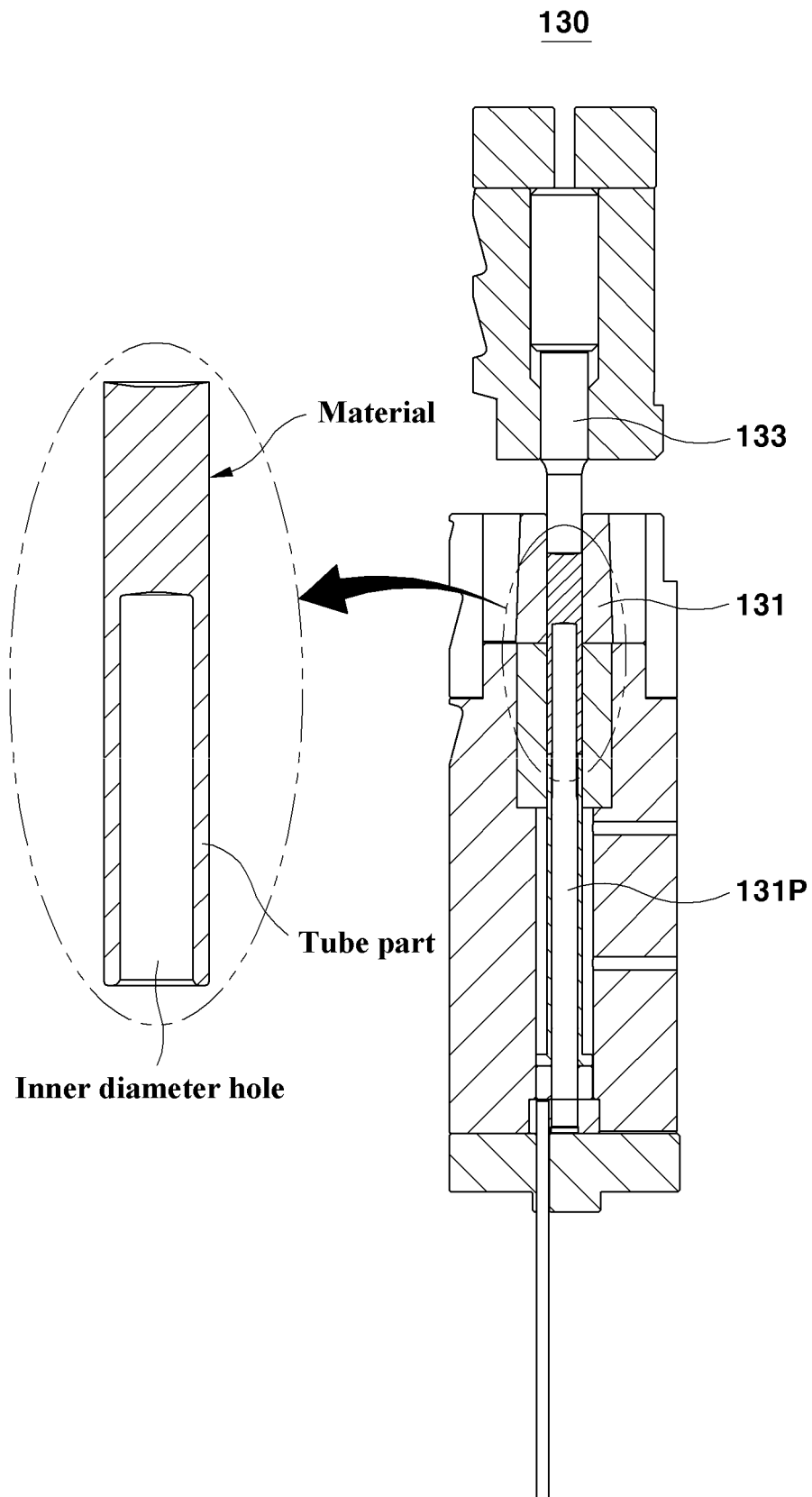


FIG. 5

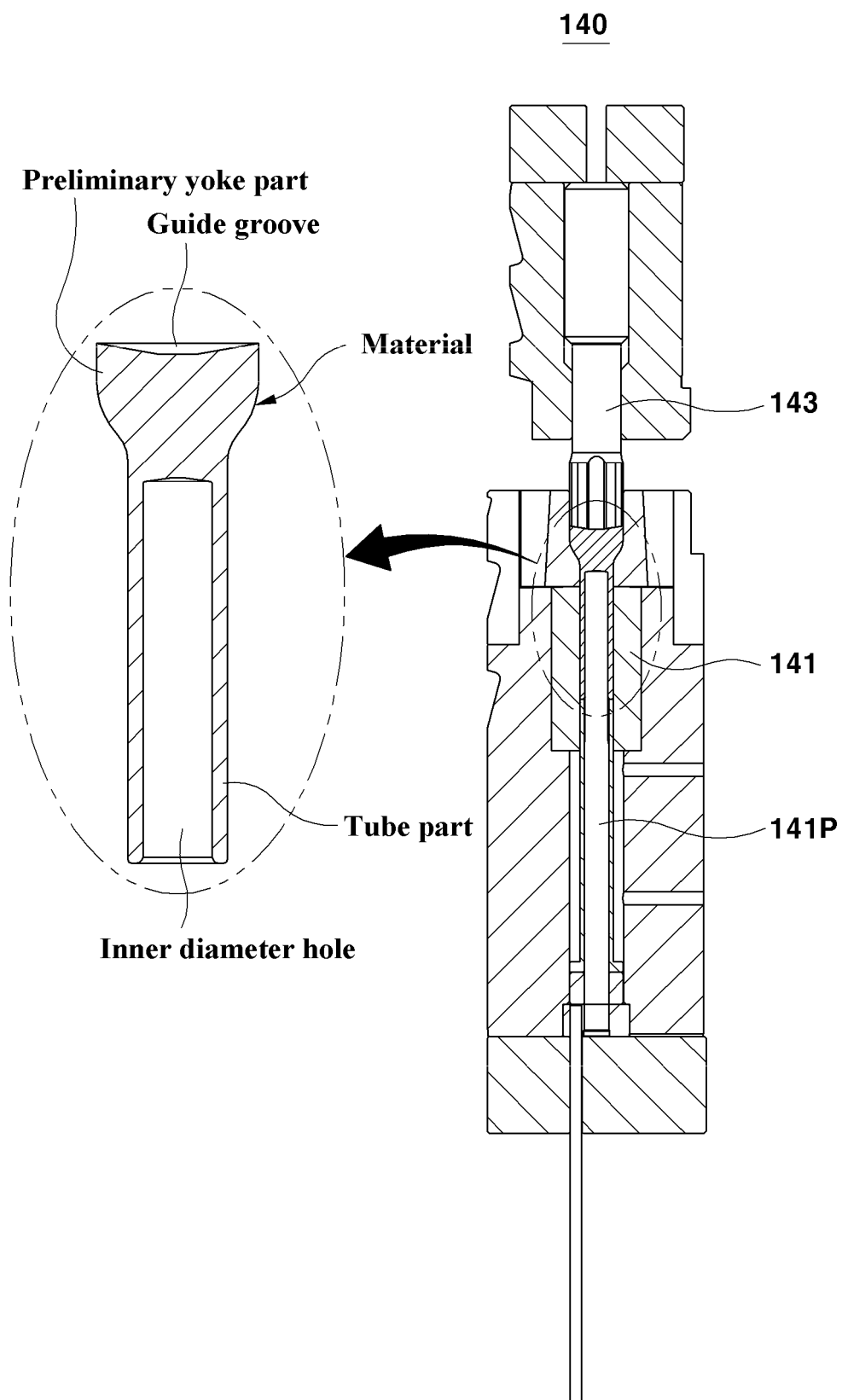


FIG. 6

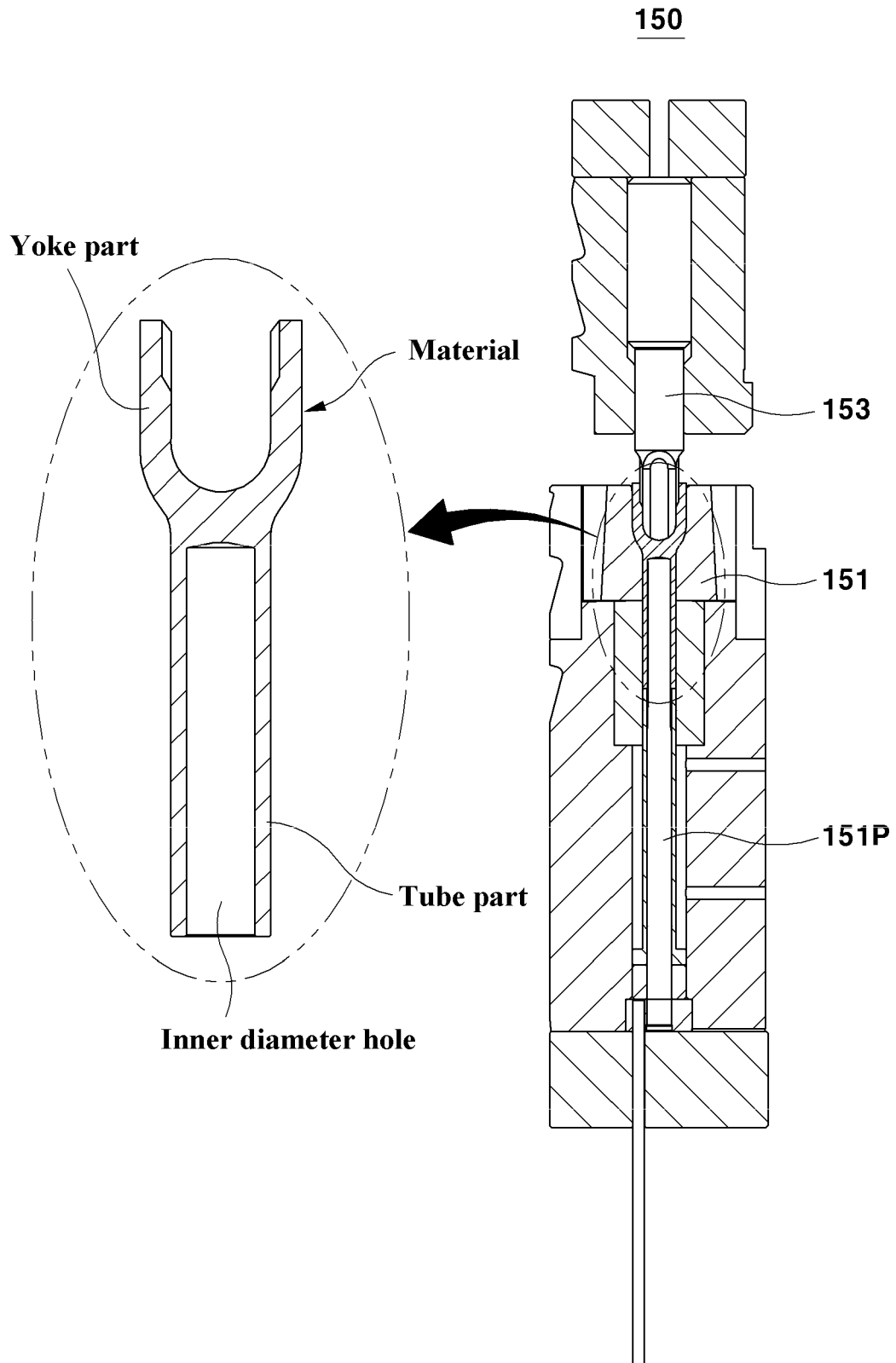


FIG. 7

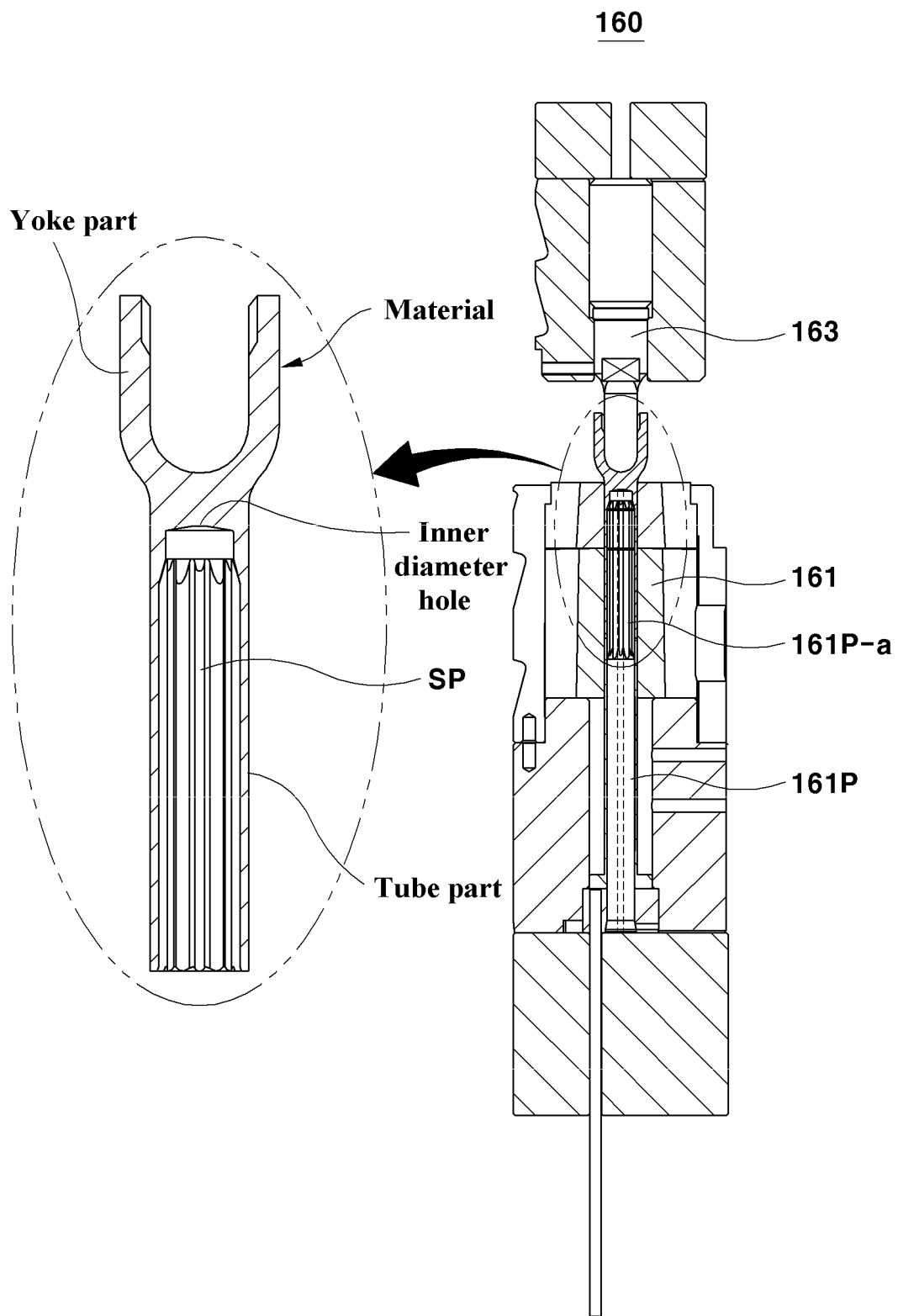


FIG. 8

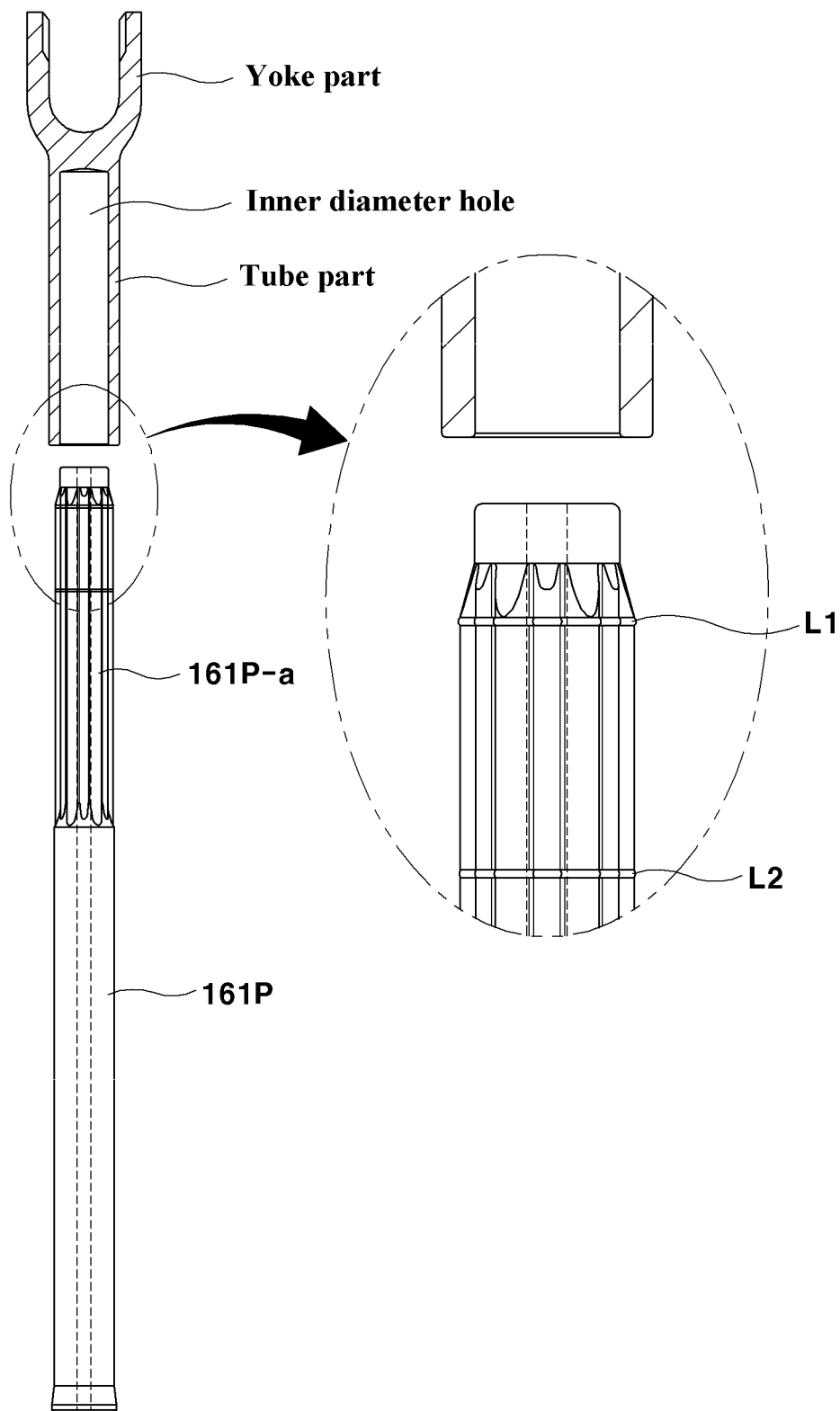


FIG. 9

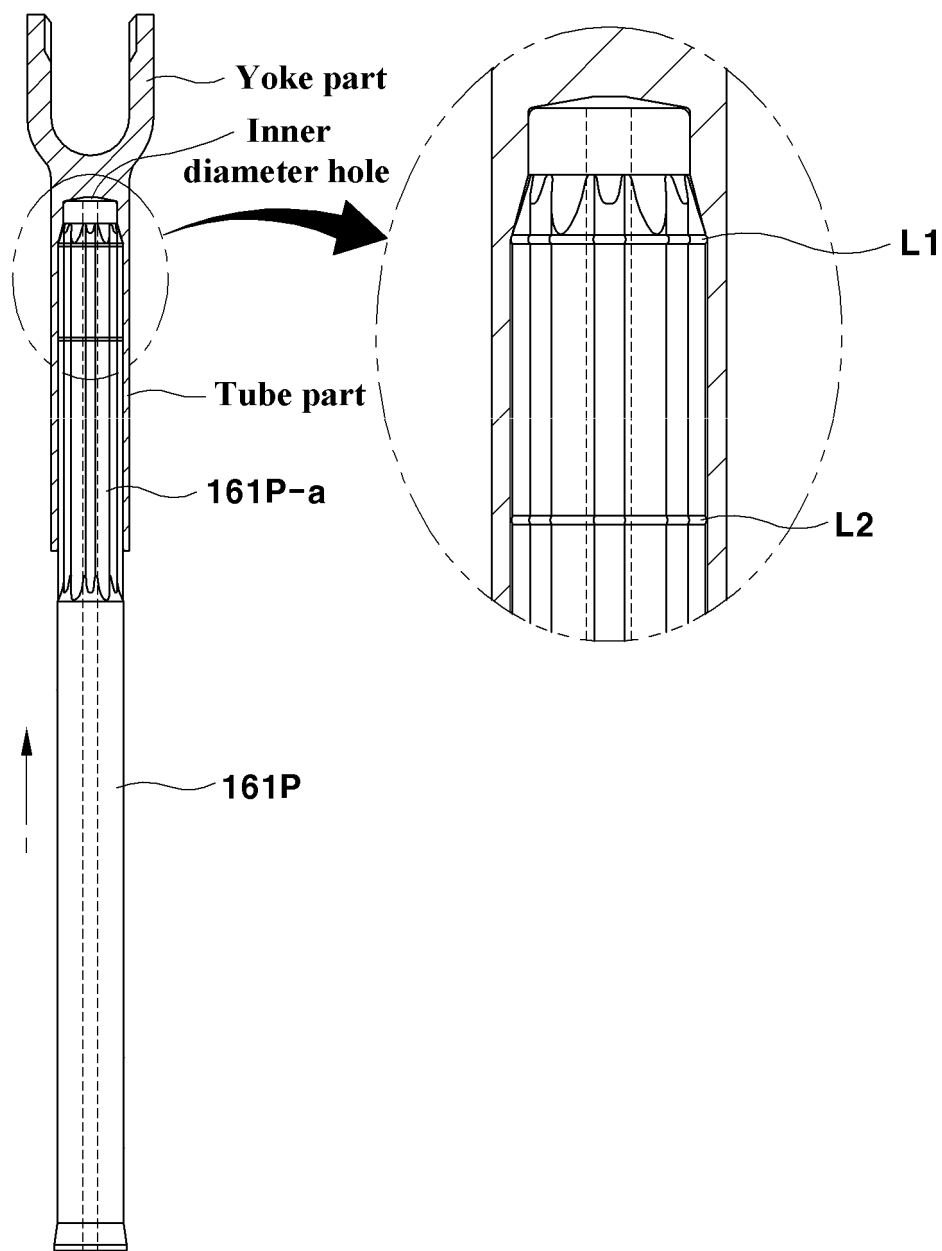


FIG. 10

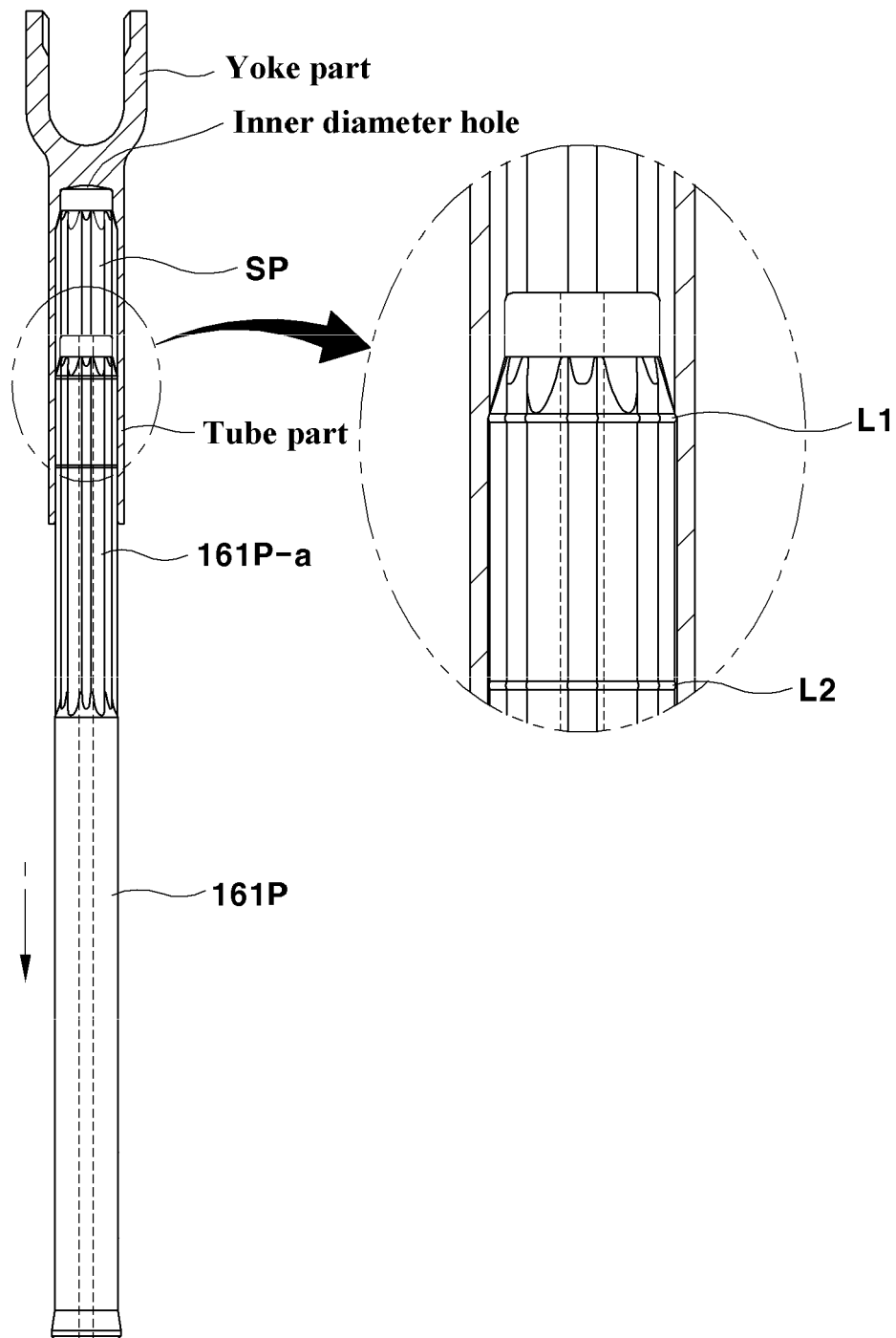


FIG. 11

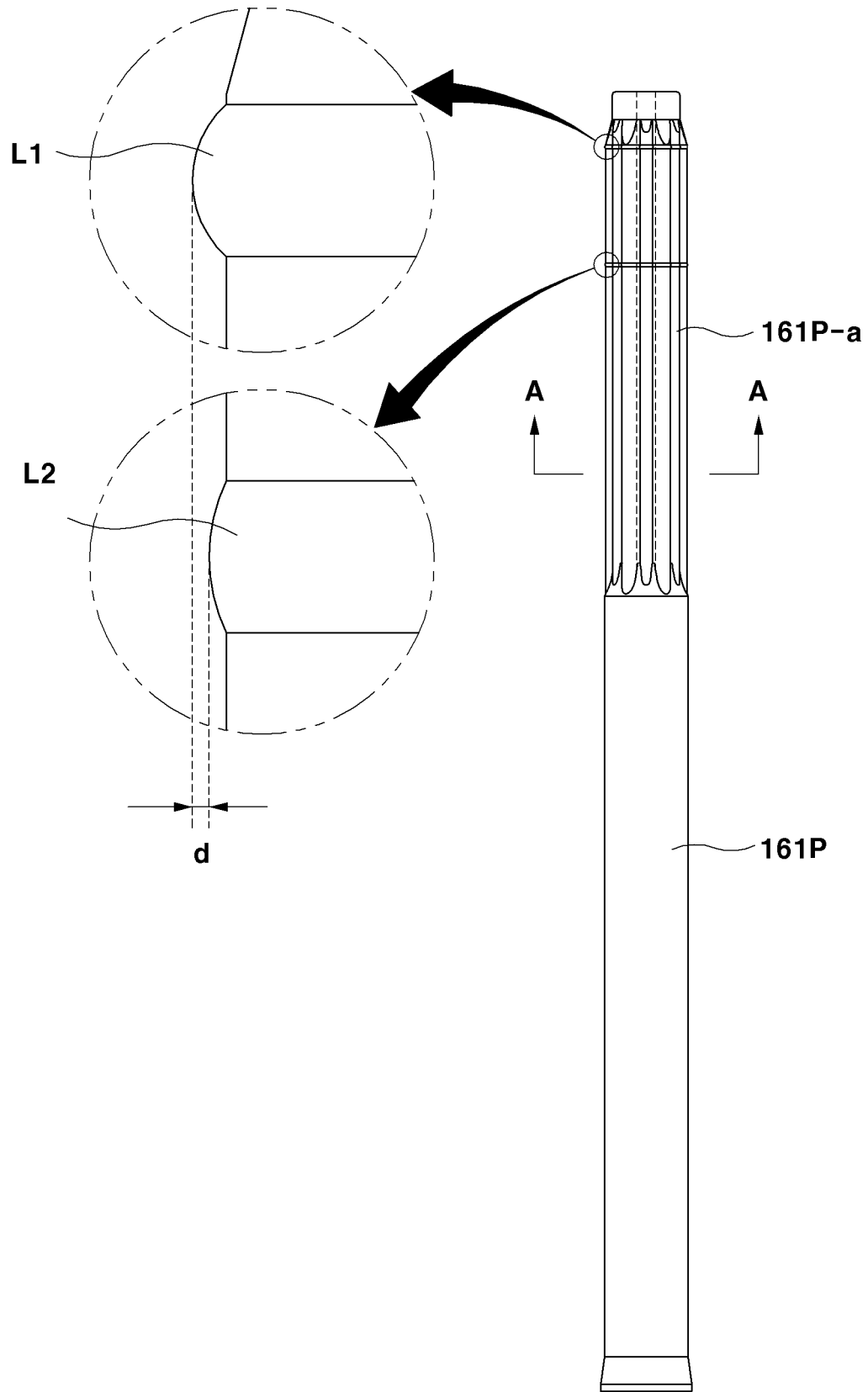


FIG. 12

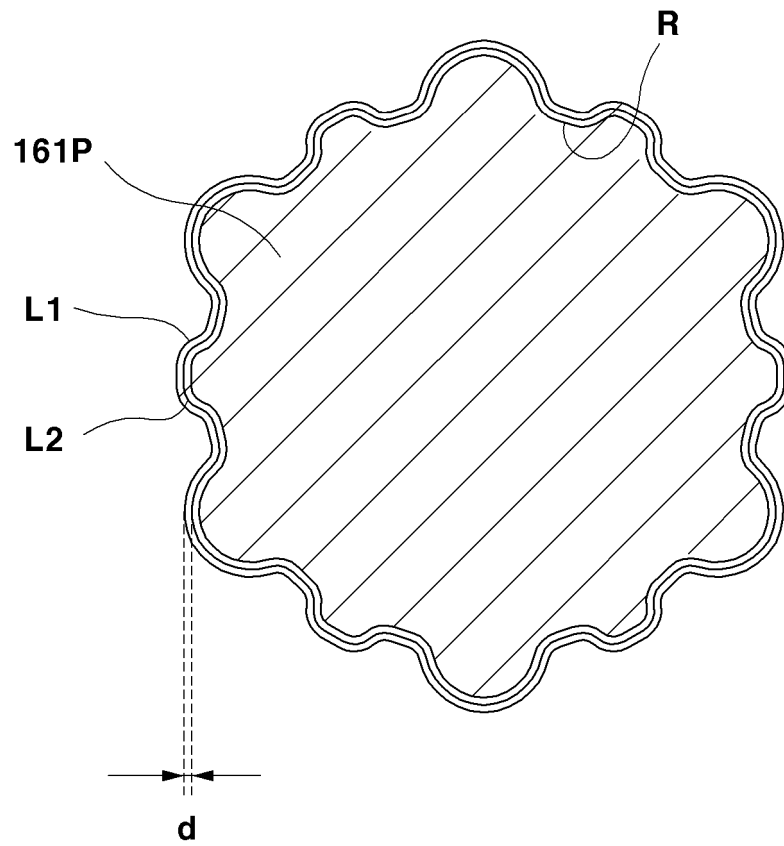


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2016/013211

A. CLASSIFICATION OF SUBJECT MATTER

B21J 13/02(2006.01)i, B21J 5/02(2006.01)i, B21J 5/06(2006.01)i, B21J 5/12(2006.01)i, B21K 1/76(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B21J 13/02; B21K 1/30; B21K 1/12; B21K 1/26; B21J 5/12; B21K 1/76; B21J 5/02; B21J 5/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models: IPC as above

Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: tube, yoke, spline, forming pin, land

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 5779913 B2 (TOYOTA MOTOR CORP.) 16 September 2015 See paragraphs [0019]-[0024] and figure 1.	1-3
A	JP 11-033662 A (TOYOTA MOTOR CORP.) 09 February 1999 See paragraph [0015] and figures 3, 4.	1-3
A	KR 10-1255809 B1 (KO, Jin Beom) 17 April 2013 See paragraphs [0039]-[0042] and figure 5.	1-3
A	JP 2013-237099 A (NIPPON STEEL & SUMITOMO METAL CORP.) 28 November 2013 See paragraphs [0037]-[0039] and figure 1.	1-3
A	KR 10-2015-0087484 A (DAERIM METAL TECHNOLOGY INDUSTRIES CO., LTD.) 30 July 2015 See paragraphs [0030], [0031] and figure 3.	1-3

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

10 FEBRUARY 2017 (10.02.2017)

Date of mailing of the international search report

10 FEBRUARY 2017 (10.02.2017)

Name and mailing address of the ISA/KR

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