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(54) Title: EXPANDABLE LOCATING PIN

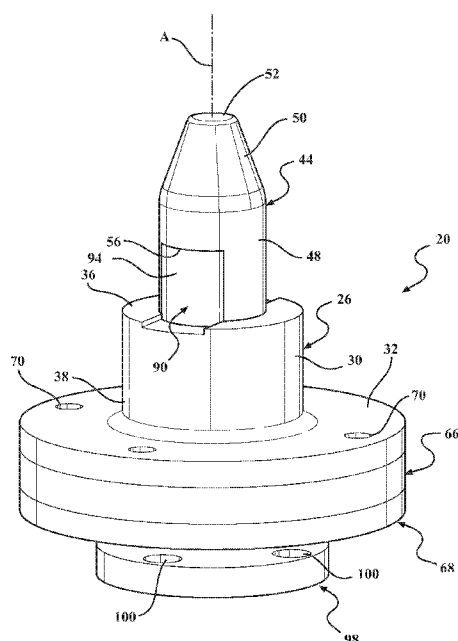


FIG. 1

(57) Abstract: A locating pin for positioning one or more workpieces on a mounting member is provided. The locating pin includes at least one cam being radially moveable between an extended position and a retracted position. The at least one cam engages the workpiece while in the extended position to hold the workpiece in place. The at least one cam is spaced from the workpiece while in the retracted position to allow the workpiece to be positioned on, or removed from the locating pin.

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EXPANDABLE LOCATING PIN

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This PCT International Patent Application claims the benefit of U.S. Provisional Patent Application Serial No. 62/466,016 entitled “Expandable Locating Pin,” filed March 2, 2017, the entire disclosure of the application being considered part of the disclosure of this application, and hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] A locating pin for positioning one or more workpieces on a mounting member. More particularly, a locating pin having cam members that are moveable between an extended position for holding the workpieces in place, and a retracted position which allows the workpieces to be positioned on, or removed from the locating pin.

2. Description of the Prior Art

[0003] In manufacturing scenarios in which a number of substantially identical workpieces are to be subjected to work procedures that are common to all of the workpieces, it is known to provide the workpieces with identically positioned pilot holes. The pilot holes are arranged for receiving one or more locating pins that are arranged on a mounting member, e.g., a jig, for locating the workpiece in a predetermined position relative to the mounting member. This arrangement allows the workpieces to be quickly placed onto and removed from the mounting member while also assuring an accurate placement of the workpieces for upcoming manufacturing operations.

[0004] An issue with conventional locating pins is that there is typically a gap provided between the locating pin and the pilot hole, thus allowing a certain amount of shifting of workpieces relative to one another. This can use up a relatively large amount of

the assembly tolerances available in the manufacturing operation. Accordingly, there remains a need for improvements to locating pins.

SUMMARY OF THE INVENTION

[0005] According to an aspect of the disclosure, a locating pin for positioning one or more workpieces on a mounting member is provided. The locating pin includes at least one cam being radially moveable between an extended position and a retracted position. The at least one cam engages the workpiece while in the extended position to hold the workpiece in place, and the at least one cam is spaced from the workpiece while in the retracted position to allow the workpiece to be positioned on, or removed from the locating pin.

[0006] According to another aspect of the disclosure, a locating pin for positioning workpieces on a mounting member is provided. The locating pin has a central body that extends axially between a base region, an intermediate region and a head region. The head region tapers inwardly to a tip for being received by a hole in the workpiece. A channel is defined by the central body and extends axially through the base region, the intermediate region and the head region and terminates prior to the tip. The intermediate region defines a pair of openings into the channel on circumferentially opposite sides of one another. A driver is slidably received by the channel of the central body. The driver extends axially between a bottom flange and a wedge portion. A pair of cams are each positioned in one of the openings of the central body for being biased outwardly into an extended portion by the wedge portion during axial movement of the driver such that the cams extend radially outwardly into engagement with the workpieces for securing the locating pin to the workpieces.

[0007] According to these and other aspects of the disclosure, the locating pin is capable of substantially eliminating the gap between the locating pin and pilot hole when the at least one cam is positioned in the extended position. As such, the subject invention

eliminates true position alignment stack up when multiple workpieces that have pilot holes of the same size are positioned on the same locating pin because the engagement of the at least one cam against the workpieces fills the gap and thus forces the workpieces into alignment with one another.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Other advantages of the present invention will be readily appreciated, as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0009] FIG. 1 is a perspective view of an example embodiment of a locating pin according to an aspect of the subject disclosure;

[0010] FIG. 2 is a side cross-sectional view of the locating pin of FIG. 1 with a pair of cams in a retracted position;

[0011] FIG. 3 is a side cross-sectional view of the locating pin of FIG. 1 with the cams in an extended position and engaging a pair of workpieces;

[0012] FIG. 4 is a perspective view of an example embodiment of a net member of a locating pin according to an aspect of the subject disclosure;

[0013] FIG. 5 is a perspective view of an example embodiment of a central body of a locating pin according to an aspect of the subject disclosure;

[0014] FIG. 6 is a side view of the central body of FIG. 5;

[0015] FIG. 7 is a front transparent view of an example embodiment of a body retainer of a locating pin according to an aspect of the subject disclosure;

[0016] FIG. 8 is a front transparent view of an example embodiment of a backing plate of a locating pin according to an aspect of the subject disclosure;

[0017] FIG. 9 is a perspective view of an example embodiment of a driver of a locating pin according to an aspect of the subject disclosure;

[0018] FIG. 10 is a perspective transparent view of an example embodiment of a cam of a locating pin according to an aspect of the subject disclosure;

[0019] FIG. 11 is a perspective transparent view of a driver retainer of a locating pin according to an aspect of the subject disclosure;

[0020] FIG. 12 is a perspective transparent view of an example embodiment of a central body, a driver and cams of a locating pin, with the cams positioned in a retracted position; and

[0021] FIG. 13 is a perspective transparent view of the central body, a driver and cams of a locating pin of FIG. 12, with the cams positioned in an extended position according to an aspect of the subject disclosure.

DESCRIPTION OF THE ENABLING EMBODIMENT

[0022] Referring to the Figures, wherein like numerals indicate corresponding parts throughout the several views, a locating pin **20** is generally shown for anchoring one or more workpieces to a mounting member, e.g., a jig, to hold the workpiece in a predetermined position while manufacturing operations are performed on the workpiece. More particularly, as best illustrated in FIGs. 2-3, the subject locating pin **20** is configured to be secured to the mounting member **24** and received by a pilot hole **25** on each of the workpieces **22**. The workpieces **22** are secured in place in a predetermined orientation and location when the workpieces **22** are attached to a plurality of the subject locating pins **20** to allow upcoming manufacturing operations to be performed on the workpieces **22**.

[0023] As best illustrated in FIGs. 1-4, the locating pin **20** includes a net member **26** that extends about and along an axis **A** and has a shaft portion **30** and an outer flange portion **32**. The shaft portion **30** generally has a tube shape **34** and extends axially between a first end **36** and a second end **38**. The outer flange portion **32** extends radially outwardly from the shaft portion **30** at the second end **38**. The shaft portion **30** further defines a hollow

40 that extends axially therethrough. An annular seat **42** extends radially inwardly into the hollow **40** at the first end **36** of the shaft portion **30**.

[0024] As best presented in FIGs. 2 and 3, a central body **44** is axially received by the hollow **40**. As best illustrated in FIGs. 5-6, the central body **44** extends axially between a base region **46**, an intermediate region **48** and a head region **50**. The head region **50** has a frustoconical shape and terminates axially at a tip **52**. The frustoconical shape of the head allows the head region **50** to be guided into the pilot holes of the workpiece(s) **22**. The central body **44** defines a channel **54** that extends axially through the base region **46**, the intermediate region **48** and terminates prior to the tip **52** in the head region **50**. The intermediate region **48** extends axially from the head region **50** in a generally tube shape **34**. The intermediate region **48** defines a pair of openings **56** into the channel **54** on circumferentially opposite sides of the intermediate region **48**. It should be appreciated that any number of openings **56** could be utilized. Each of the openings **56** extends axially between an upper end **58** and a lower end **60**. As best illustrated in FIGs. 2 and 3, the lower end **60** of the openings **56** is approximately axially aligned with the annular seat **42** of the net member **26**. The base region **46** extends axially from the intermediate region **48** in a cylindrical shape and terminates at a second end **47**. The base region **46** has a larger outer diameter than the outer diameter of the intermediate region **48**. A step **62** is defined at the interface of the base region **46** and the intermediate region **48**. The base region **46** has an inner flange **64** that extends radially outwardly at the second end **38**.

[0025] As best illustrated in FIGs. 2-3 and 7, a generally washer-shaped body retainer **66** underlies the outer flange portion **32** and is disposed circumferentially about the inner flange **64** for holding the central body **28** in place. As best illustrated in FIGs. 2-3 and 8, a generally washer-shaped backing plate **68** underlies the body retainer **66**. The outer flange portion **32**, the body retainer **66** and the backing plate **68** together define a plurality

of securement passages **70** that extend axially therethrough each for receiving a fastener for securing the outer flange portion **32**, the body retainer **66** and the backing plate **68** to one another and for securing the locating pin **20** to the mounting member **24**.

[0026] As best illustrated in FIGs. 2-3 and 9, a driver **72** is moveably received by the channel **54** of the central body **44**. The driver **72** extends axially between a bottom flange **74**, a cylinder **76**, and a wedge **78**. The bottom flange **74** extends radially outwardly from the cylinder **76**. The wedge **78** extends axially from the cylinder **76** and terminates at an end face **80**. The wedge **78** further has an upper face **82** and a lower face **84** positioned in parallel relationship with one another, and a pair of side faces **86** between the upper and lower faces **82**, **84**. The side faces **86** tapers inwardly as they extend axially to the end face **80**. The upper and lower faces **82**, **84** each define a slot **88** that extends axially away from the end face **80**.

[0027] As best illustrated in FIGs. 2-3 and 10, a pair of cams **90** are each positioned in one of the openings **56** of the central body **44** and constrained axially by the upper and lower ends **58**, **60** of the opening **56**. The cams **90** are arranged to move radially between a retracted position (shown in FIGs. 2 and 12) and an extended position (shown in FIGs. 3 and 13) in response to engagement by the wedge **78** of the driver **72** during axial movement of the driver **72** toward the head region **50**. Such movement of the cams **90** to the expanded position causes the cams **90** to engage the workpieces **22** in the pilot hole **25**, therefore eliminating any gap between the locating pin **20** and pilot holes **25**. On the other hand, when the cams **90** are in the retracted position, a gap is provided between the cams **90** and the workpieces **22** to allow the workpieces **22** to easily be positioned on, or removed from the locating pin **20**. As best illustrated in FIG. 10, each of the cams **90** extends axially between a lower portion **99** and an upper portion **101**. Furthermore, each of the cams **90** has a box portion **92** and an arcuate portion **94**, with the arcuate portion **94** positioned perpendicularly

to the box portion **92**. The box portion **92** has an inner face **96** presenting an axially extending protrusion **97** for being received by the slot **88** of one of the upper and lower faces **82, 84** of the wedge **78** for guiding the wedge **78** axially during axial movement of the driver **72** relative to the cams **90**. The arcuate portion **94** has an inside face **103** being generally planar and an outside face **105** generally having an arc shape. The inside face **103** tapers inwardly as it extends axially between the upper portion **101** and the lower portion **99**. Furthermore, the inside face **104** engages one of the side faces **86** of the wedge **78** to provide radial outward movement of the cam **90** as the wedge **78** is moved axially toward the head **50**. It should be appreciated that the angle of the wedge **89** and inside face **104** of the cam **90** may be adjusted to provide a desired amount of radial movement of the cam **90**. It should also be appreciated that a single cam **90**, or more than two cams **90** could be utilized.

[0028] As best illustrated in FIGs. 2-3 and 10-11, a generally washer-shaped driver retainer **98** is secured to the bottom flange **74** of the driver **72**. The driver retainer **98** defines a plurality of securement holes **100** for being attached to an air cylinder or other actuating device to drive the driver **72** axially forward to bias the cams **90** outwardly in their extended positions, or inwardly into their retracted positions.

[0029] Obviously, many modifications and variations of the present invention are possible in light of the above teachings and may be practiced otherwise than as specifically described while within the scope of the appended claims. These antecedent recitations should be interpreted to cover any combination in which the inventive novelty exercises its utility. The use of the word "said" in the apparatus claims refers to an antecedent that is a positive recitation meant to be included in the coverage of the claims whereas the word "the" precedes a word not meant to be included in the coverage of the claims.

CLAIMS

What is claimed is:

Claim 1. A locating pin for positioning one or more workpieces on a mounting member including:

at least one cam being radially moveable between an extended position and a retracted position;

wherein the at least one cam engages the workpiece while in the extended position to hold the workpiece in place, and wherein the cam is spaced from the workpiece while in the retracted position to allow the workpiece to be positioned on, or removed from the locating pin.

Claim 2. The locating pin as set forth in claim 1 further including a driver extending along an axis and located radially inwardly of the at least one cam and including a wedge portion in axial alignment with the at least one cam, wherein the wedge portion tapers radially inwardly such that axially movement of the driver provides the radial movement of the cam between the extended and retracted positions.

Claim 3. The locating pin as set forth in claim 2 wherein the at least one cam includes a pair of cams positioned on opposing sides of the wedge portion of the driver.

Claim 4. The locating pin as set forth in claim 2 further including a central body presenting an outer wall and defining a channel extending axially, wherein the outer wall defines at least one opening into the channel, wherein the at least one cam is positioned in the opening of the outer wall and radially moveable relative to the outer wall, and wherein the driver is received by the channel and axially moveable within the channel.

Claim 5. The locating pin as set forth in claim 4 wherein the at least one opening includes a pair of openings on circumferentially opposite sides of the central body from one another, and wherein the at least one cam includes a pair of cams each positioned in one of the openings.

Claim 6. The locating pin as set forth in claim 5 wherein the central body extends axially from a base region to an intermediate region to a head region, wherein the head region tapers inwardly to a tip for guiding the central body into a hole in the workpiece and wherein the pair of channels are defined by the intermediate region beneath the head region.

Claim 7. The locating pin as set forth in claim 6 wherein the base region of the central body includes a flange extending radially outwardly beneath the intermediate region.

Claim 8. The locating pin as set forth in claim 2 wherein the wedge portion of the driver defines at least one slot extending axially, and wherein the at least one cam presents a protrusion extending axially and received by the slot of the wedge for guiding the wedge as it axially moves relative to the at least one cam.

Claim 9. The locating pin as set forth in claim 2 further including a net member that extends about and along the axis and includes a shaft portion generally having a tube shape and an outer flange portion extending radially outwardly from the shaft portion for engaging the mounting member, and wherein the net member defines a hollow extending therethrough, and wherein the central body is received by the hollow.

Claim 10. The locating pin as set forth in claim 9 wherein a body retainer underlies the outer flange portion.

Claim 11. The locating pin as set forth in claim 10 wherein a backing plate underlies the body retainer.

Claim 12. The locating pin as set forth in claim 11 wherein the outer flange portion, the body retainer and the backing plate together define a plurality of securement passages extending axially therethrough each for receiving a fastener for securing the outer flange portion, the body retainer and the backing plate to one another and for securing the locating pin to the mounting member.

Claim 13. A locating pin for positioning workpieces on a mounting member, the locating pin comprising:

- a central body extending between a base region an intermediate region and a head region;

- the head region tapering inwardly to a tip for being received by a hole in the workpiece;

- a channel defined by the central body and extending axially through the base region the intermediate region and the head region and terminating prior to the tip;

- the intermediate region defining a pair of openings into the channel on circumferentially opposite sides of one another;

- a driver slidably received by the channel of the central body, the driver extending axially between a bottom flange and a wedge portion;

a pair of cams each positioned in one of the openings of the central body for being biased outwardly into an extends position by the wedge portion during axial movement of the driver such that the cams extend radially outwardly into engagement with the workpieces for securing the locating pin to the workpieces.

Claim 14. The locating pin as set forth in claim 13 wherein the wedge portion of the driver defines a pair of slots extending axially, and wherein each of the cams presents a protrusion extending axially and received by one of the slots of the wedge for guiding the wedge as it axially moves relative to the pair of cams.

Claim 15. The locating pin as set forth in claim 13 further including a net member that extends about and along the axis and includes a shaft portion generally having a tube shape and an outer flange portion extending radially outwardly from the shaft portion for engaging the mounting member, and wherein the net member defines a hollow extending therethrough, and wherein the central body is received by the hollow.

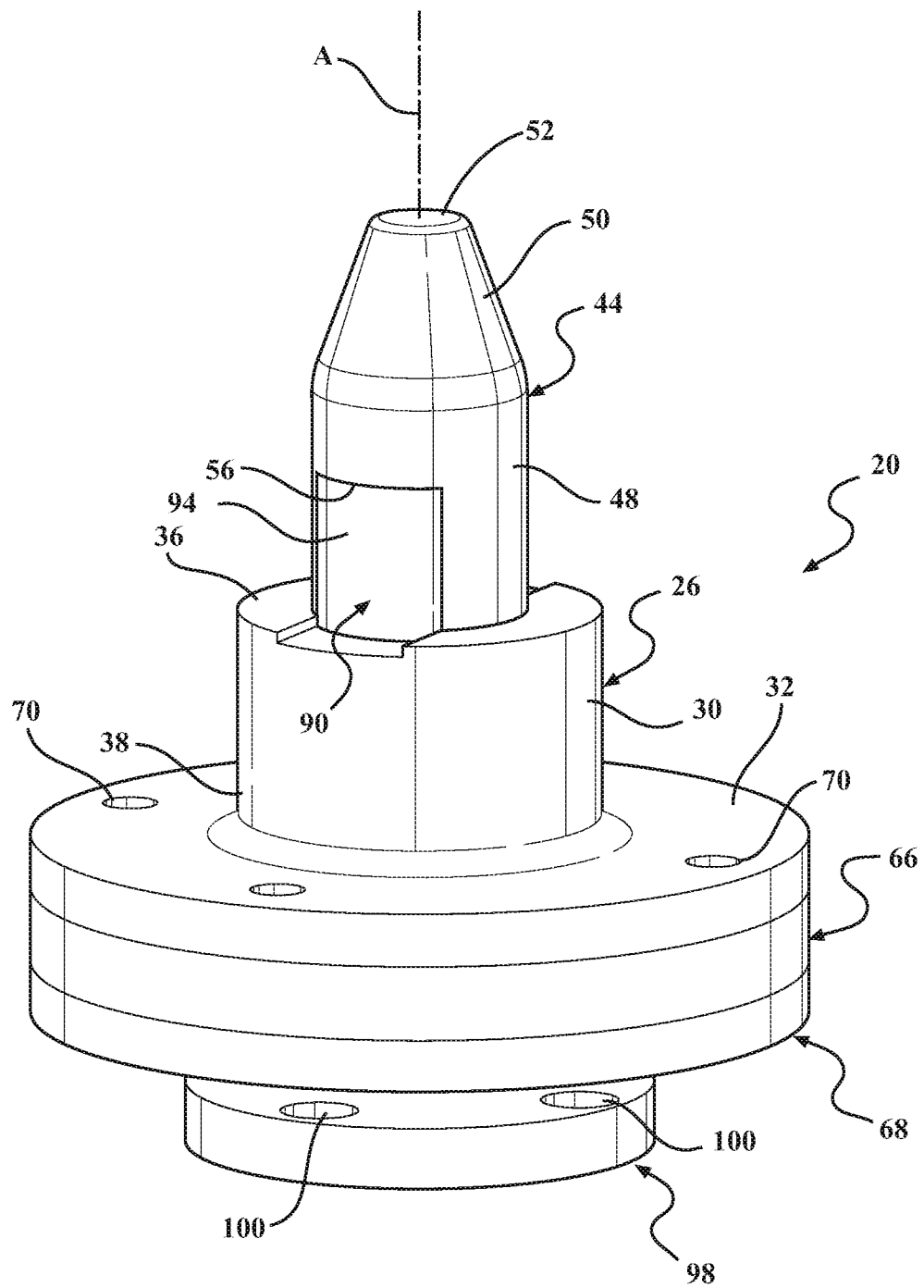


FIG. 1

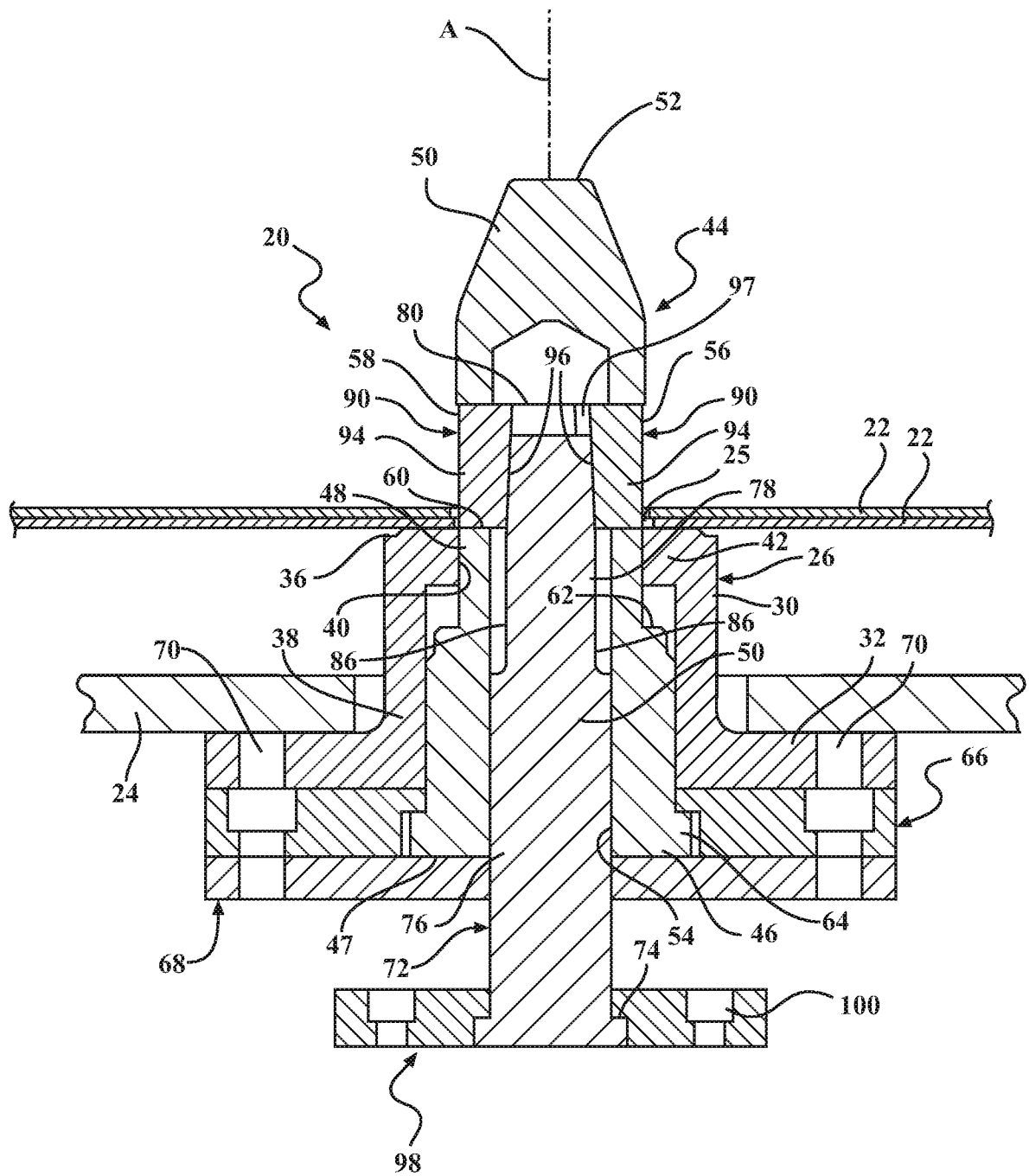


FIG. 2

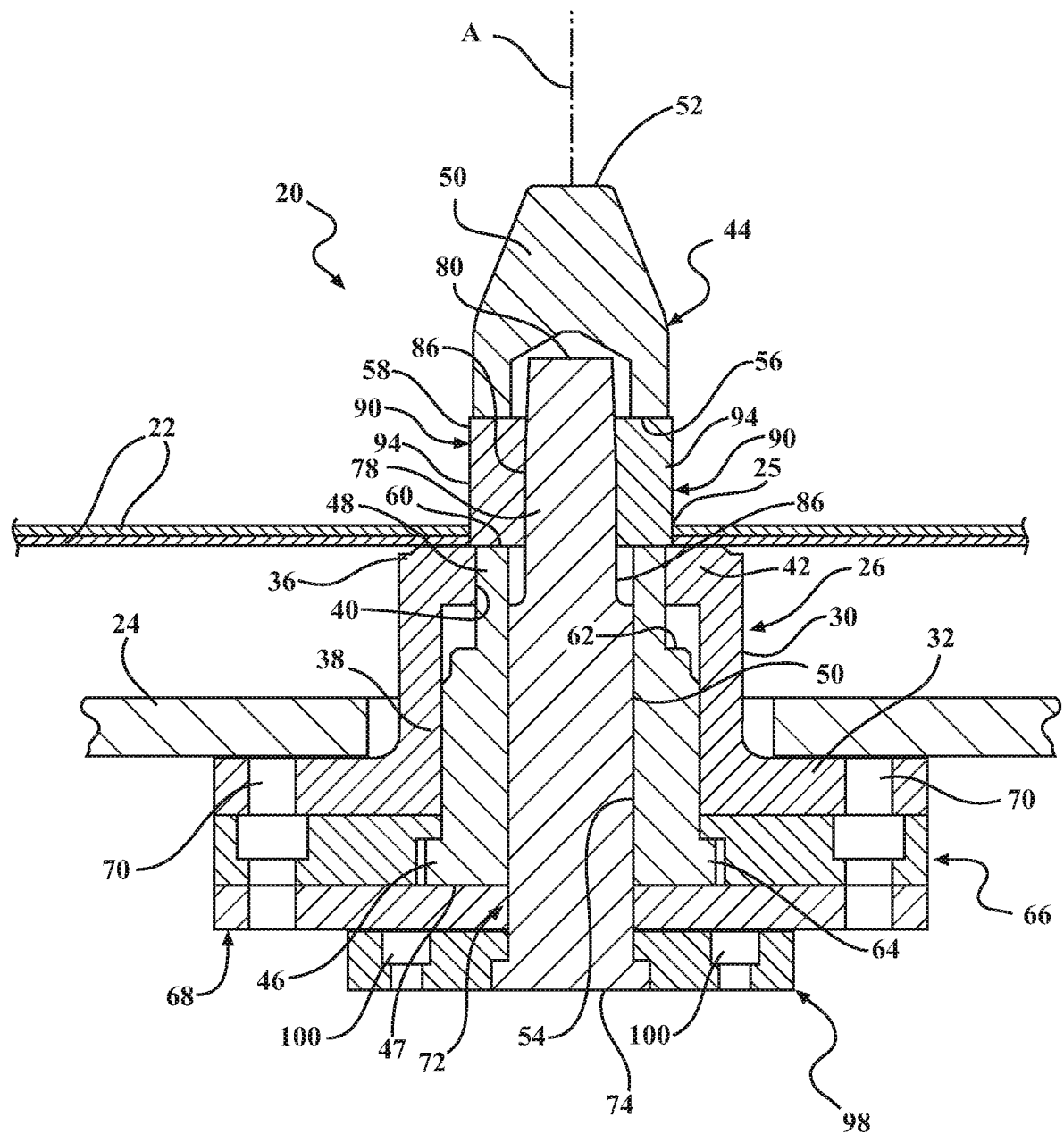


FIG. 3

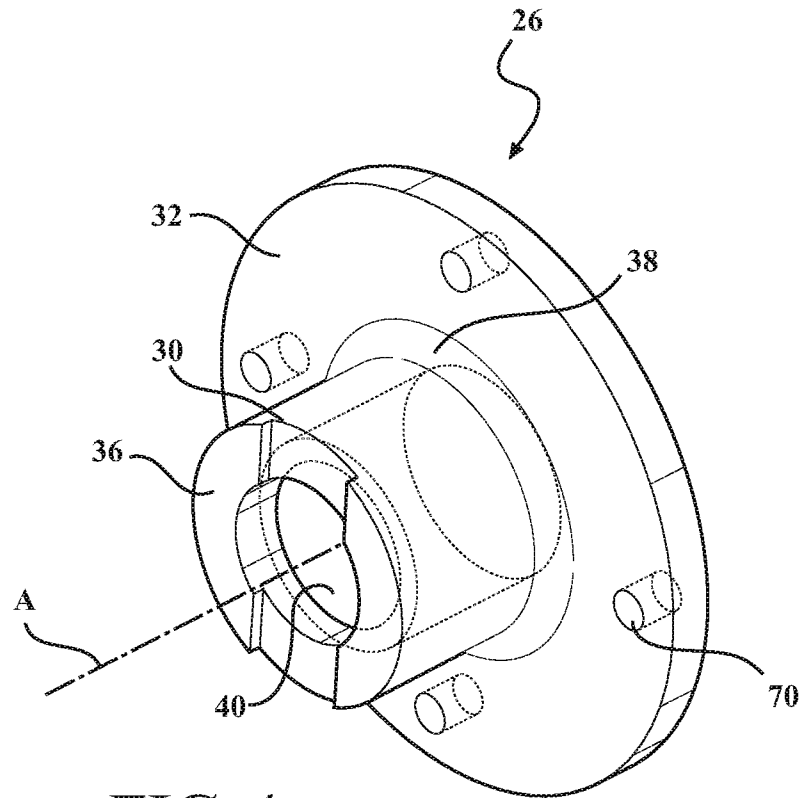


FIG. 4

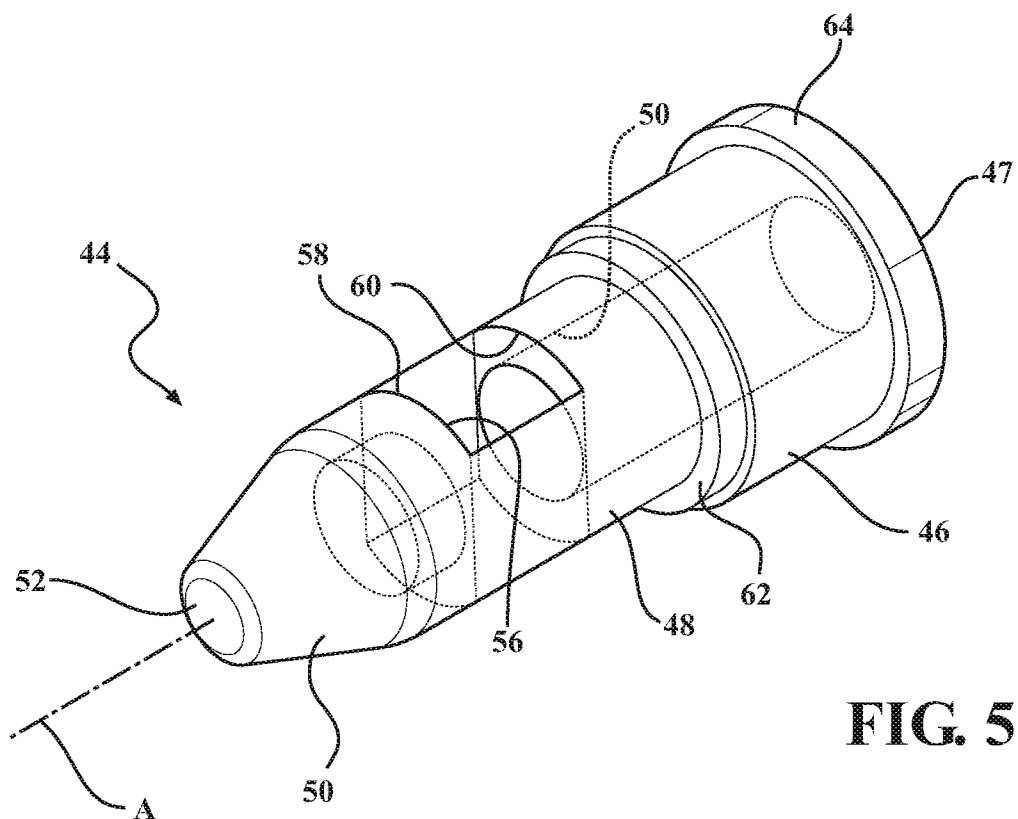


FIG. 5

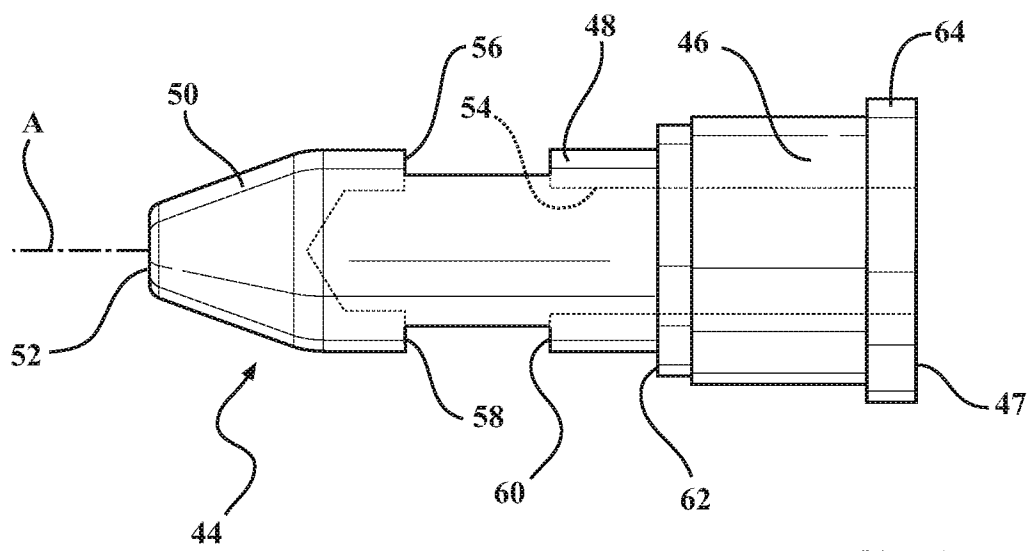


FIG. 6

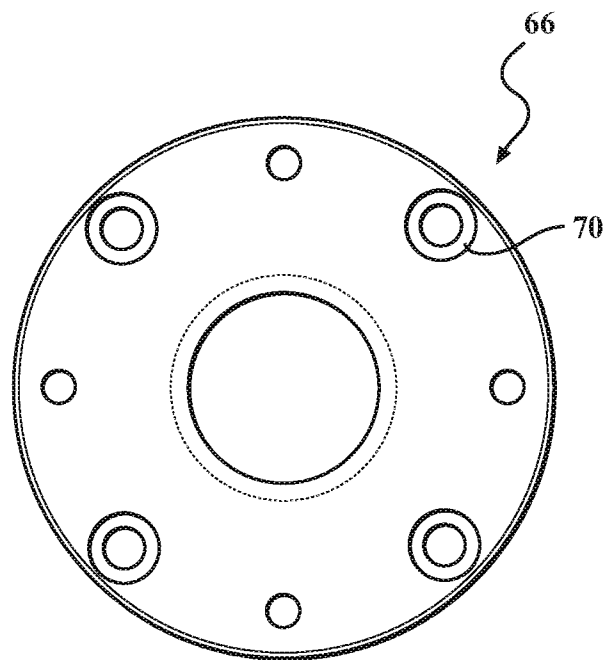
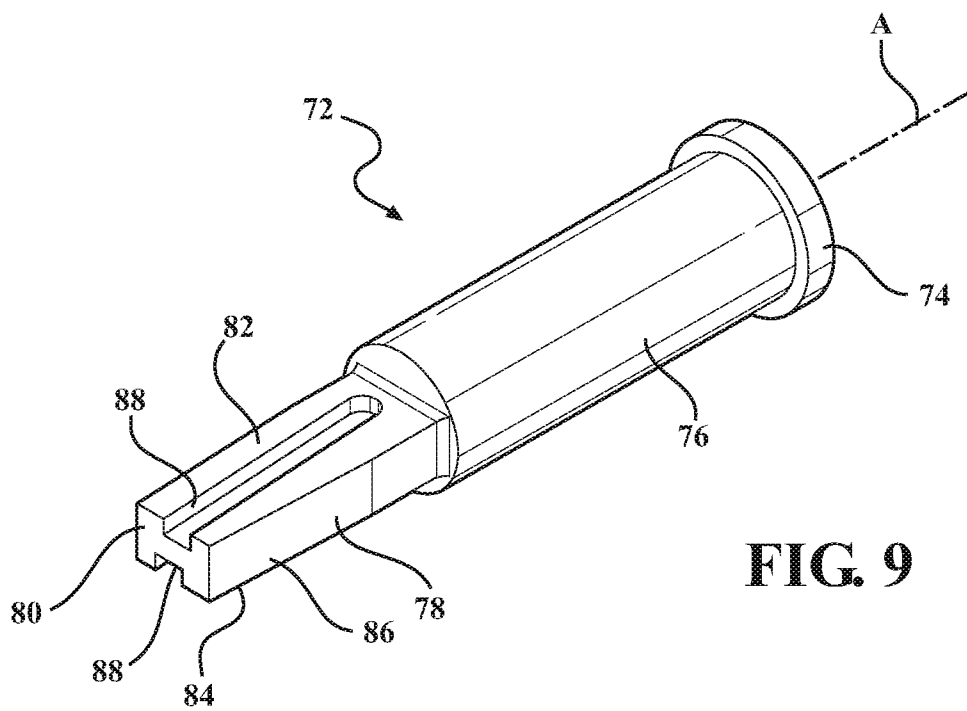
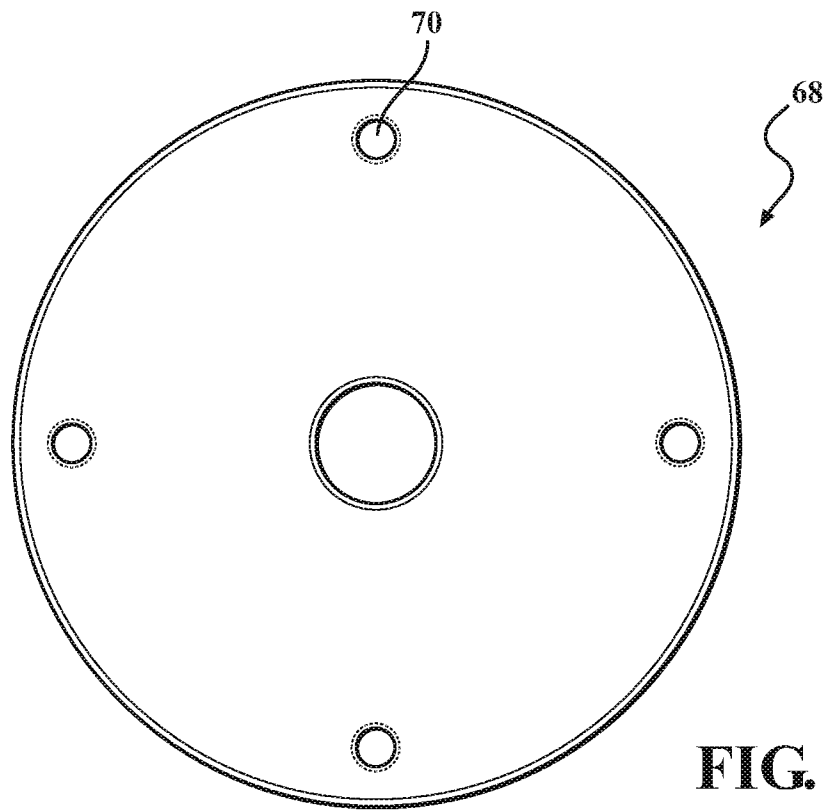


FIG. 7



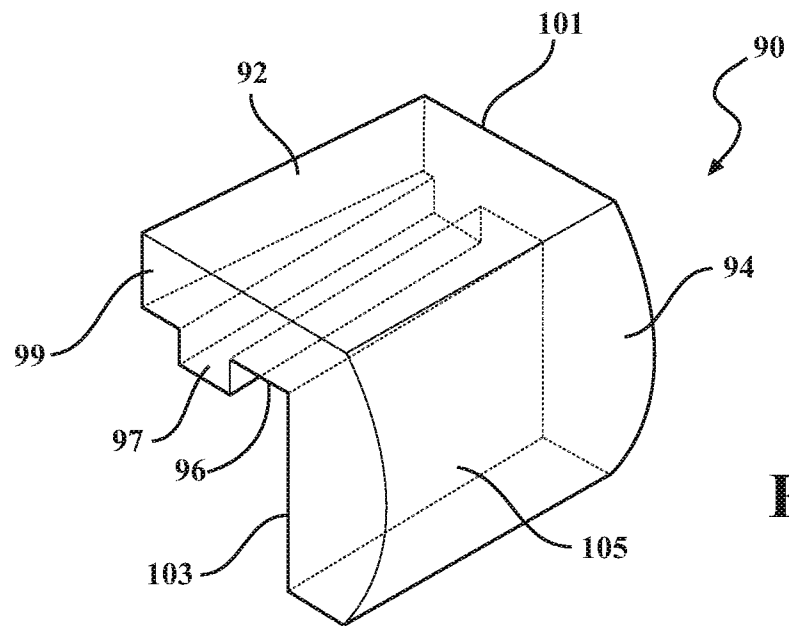


FIG. 10

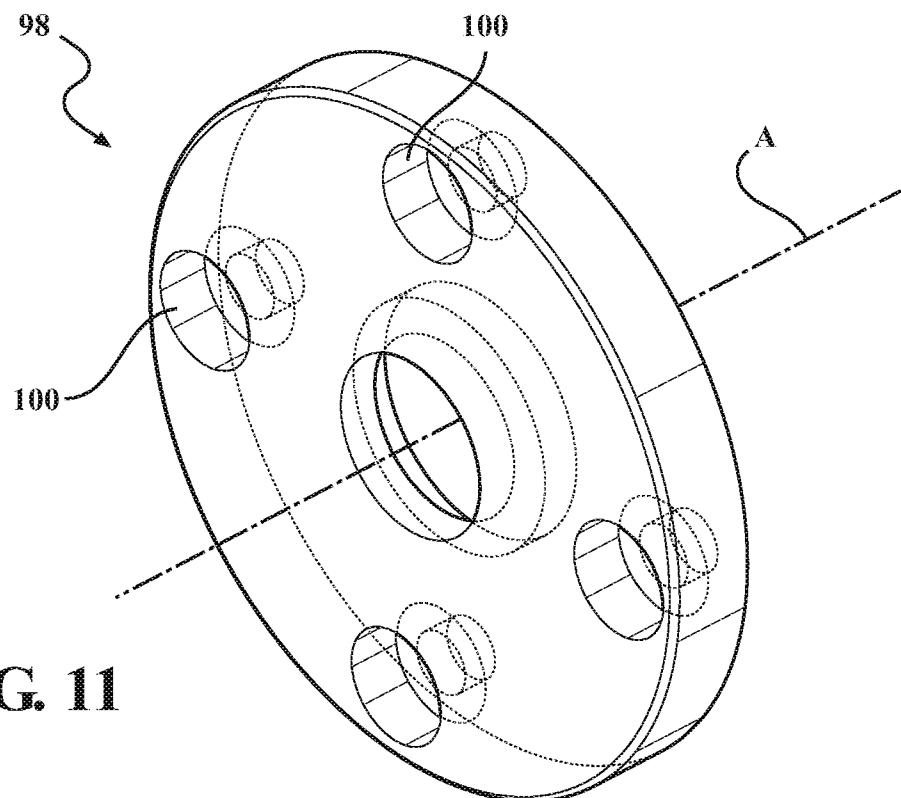


FIG. 11

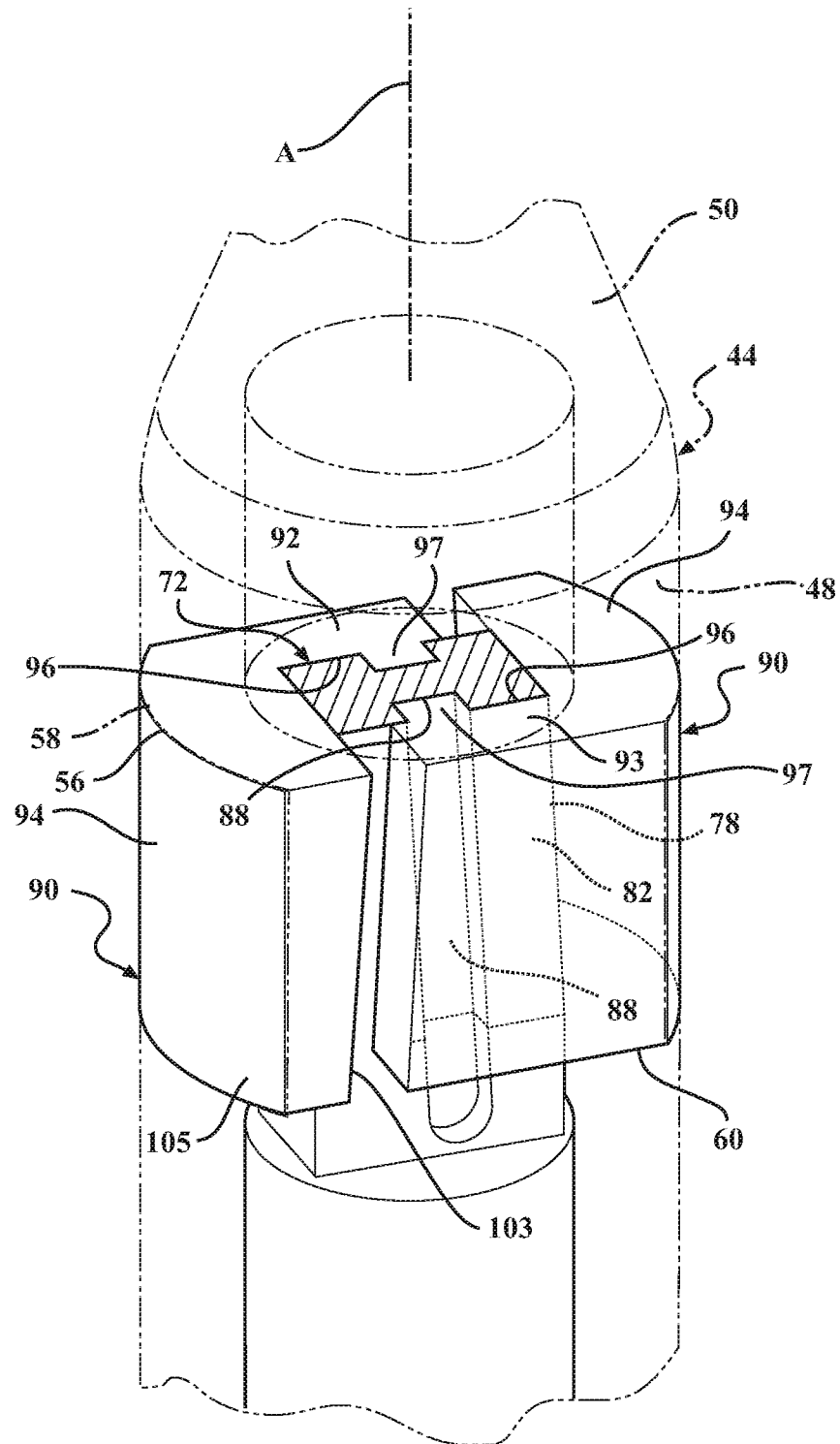


FIG. 12

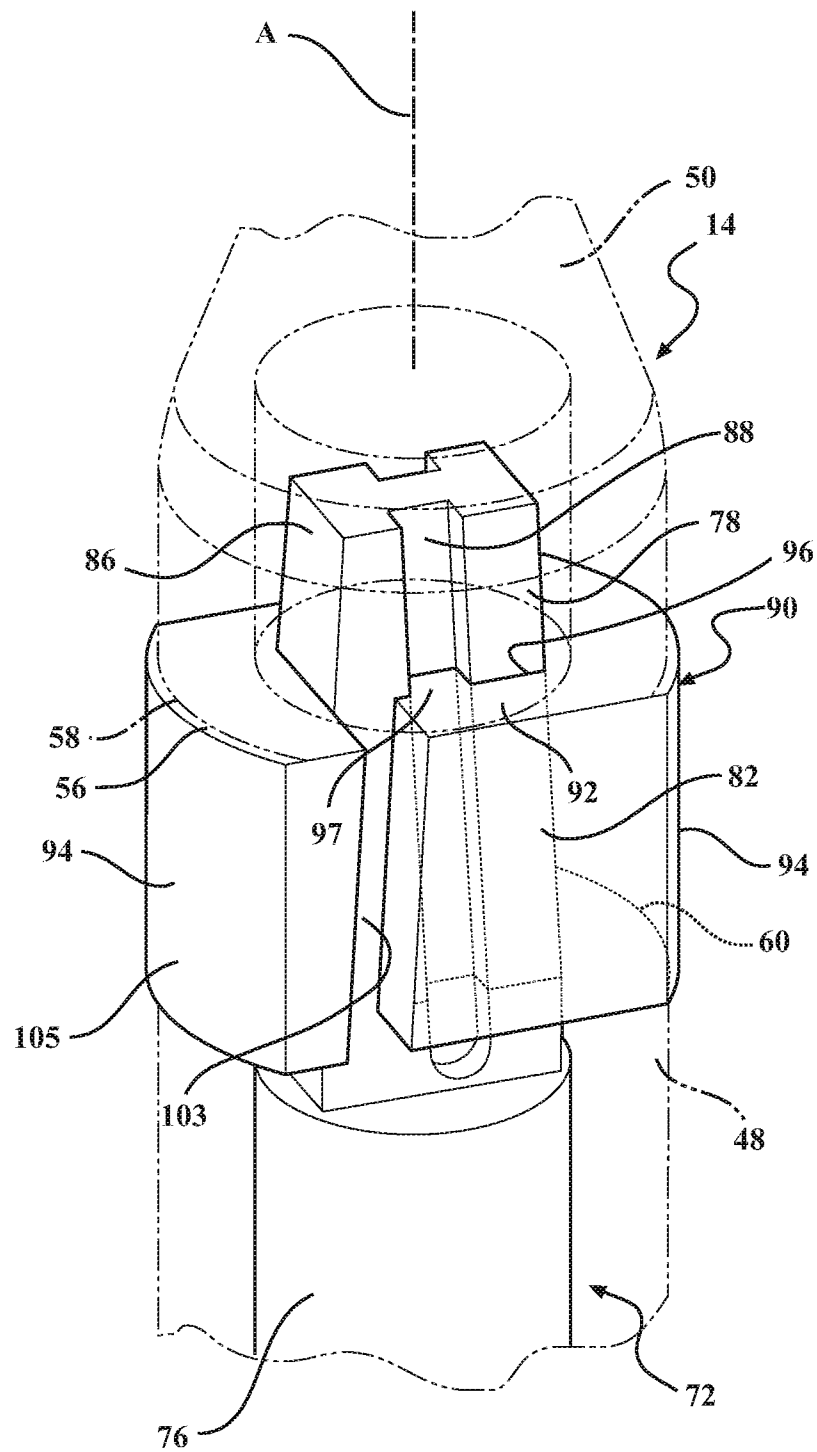


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 18/20736

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - F16B 2/04, F16B 13/04, F16B 13/06, F16B 13/08, F16B 13/10, B23Q 3/08, B23Q 3/06 (2018.01)
 CPC - F16B 13/0858, F16B 13/0891, Y10T 403/557, Y10T 403/75, B23Q 3/18, F16B 13/06, F16B 2/04,
 F16B 5/0088, F16B 13/068, F16B 13/063, F16B 13/0816, F16B 2013/10, B23Q 3/08, B23Q 3/06

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)

See Search History Document

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

See Search History Document

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

See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 2014/0056668 A1 (DEMMELE) 27 February 2014 (27.02.2014), entire document, especially Fig. 1B, 3B, 3C; para [0040]-[0041], [0044]-[0045], [0052].	1-2, 4 ----- 3, 5-7, 13
Y	WO 2016/020028 A1 (SIEGMUND) 11 February 2016 (11.02.2016), entire document, especially Fig. 2, 4a; pg. 10.	3, 5-7, 13
A	US 2008/0315478 A1 (MCINTOSH) 25 December 2008 (25.12.2008), entire document, especially Fig. 1; para [0038]-[0039].	1-15
A	US 2004/0070130 A1 (PAVLIK et al.) 15 April 2004 (15.04.2004), entire document.	1-15
A	"Welker Expanding Locating Pin" (WALKER ENG) 19 November 2013 (19.11.2013); retrieved from internet 26.04.2018; <URL=https://www.youtube.com/watch?time_continue=1&v=5M_s03n0-eQ>; entire document.	1-15
X/P	DE 10 2016 015 041 A1 (OLAF UND ANDRE TUNKERS GBR) 21 December 2017 (21.12.2017), entire document.	1-15

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

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Date of the actual completion of the international search

26 April 2018

Date of mailing of the international search report

24 MAY 2018

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