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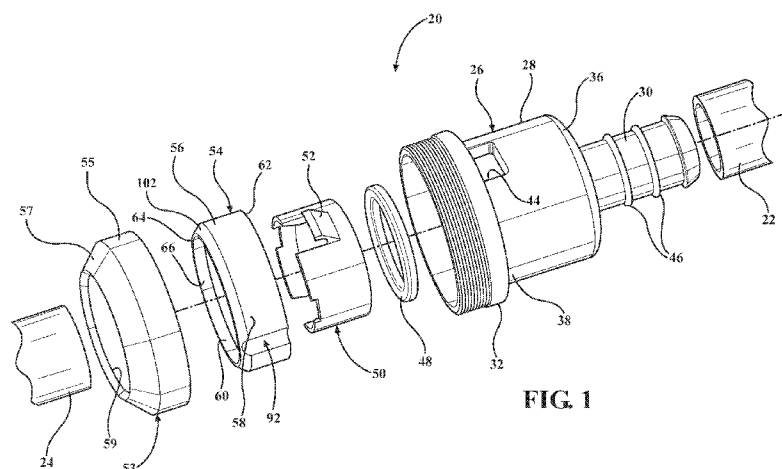


FIG. 1

(57) Abstract: A quick-connector connecting a first pipe and a second pipe. The quick-connector includes a housing that extends about a first axis and defines a bore that extends axially therethrough. A grab ring is disposed in the bore of the housing and includes a body that extends about and along the first axis between a first end and a second end and defines a passage that extends between the first and second ends for receiving one of the first or second pipes. A plurality of protrusions extend from the body in the passage for clamping against the received pipe to prevent the received pipe from being axially removed from the passage. A plurality of hinges are spaced from one another about the body for allowing the body to uniformly and circumferentially flex about the hinges relative to the first axis when the first or second pipe is received in the passage.

QUICK-CONNECTOR

CROSS REFERENCE TO RELATED APPLICATION

[0001] This PCT Patent Application claims the benefit of and priority to U.S. Utility Patent Application Serial No. 14/795,371 filed July 9, 2015, 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 quick-connector for establishing fluid communication between a first pipe and a second pipe.

2. Description of the Prior Art

[0003] Quick-connectors are utilized in numerous fields, including the automotive industry, for quickly connecting and establishing fluid communication between first and second pipes. An example of a quick-connector is disclosed in U.S. Patent Application Publication No. US 2013/0168959 to Marc Timothy Turk which includes a housing that extends about and along a first axis and defines a bore that extends axially therethrough. A grab ring is disposed in the bore of the housing and includes a body that extends about and along the first axis between a first end and a second end. The body defines a passage that extends between the first and second ends for receiving a pipe. A plurality of teeth extend from the body in the passage for clamping against the received pipe to prevent the received pipe from being axially removed from the passage. It is further known for the grab ring to include a hinge that allows the body of the grab ring to be flexed outwardly about the hinge to widen the passage so that it may receive the pipe, as disclosed in U.S. Patent No. 5,603,532 to John D. Guest.

[0004] A known issue with such quick-connectors is that the teeth of the grab ring forcefully engage the pipe during insertion of the pipe into the passage, thus leading to scoring or other damage to the pipe. Although the single hinge loosens some of the teeth relative to the pipe, other teeth remain forcefully engaged against the pipe and thus still damage the pipe. Accordingly, there remains a need for an improved quick-connector that provides a quick and easy connection between pipes that does not damage the pipes.

SUMMARY AND ADVANTAGES OF THE INVENTION

[0005] The invention provides for a quick-connector for establishing fluid communication between a first pipe and a second pipe. The quick-connector includes a housing that extends about and along a first axis and defines a bore that extends axially therethrough. A grab ring is disposed in the bore of the housing and includes a body that extends about and along the first axis between a first end and a second end. The grab ring further defines a passage that extends between the first and second ends for receiving one of the first or second pipes. A plurality of protrusions extend from the body in the passage for clamping against the received pipe to prevent the received pipe from being axially removed from the passage. A plurality of hinges are spaced from one another about the body for allowing the body to flex circumferentially about the hinges when the first or second pipe is received in the passage, thereby more uniformly distributing the clamping forces on the received pipe by the plurality of protrusions. This prevents scoring of the pipe during insertion of the pipe into the passage of the grab ring.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] 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:

[0007] Figure 1 is a perspective exploded view of a quick-connector according to an aspect of the disclosure;

[0008] Figure 1A is a side cross-sectional view of the quick-connector;

[0009] Figure 2 is an end view of a tooth insert of the quick-connector;

[0010] Figure 3 is a perspective view of a first exemplary embodiment of a grab ring of the quick-connector according to an aspect of the disclosure;

[0011] Figure 3A is a side cross-sectional view of the grab ring of Figure 3 taken along line 3A-3A of Figure 3;

[0012] Figure 3B is a front view of the grab ring of Figure 3;

[0013] Figure 4 is a perspective view of a second exemplary embodiment of a grab ring of the quick-connector according to an aspect of the disclosure;

[0014] Figure 4A is a side cross-sectional view of the grab ring of Figure 4 taken along line 4A-4A of Figure 4;

[0015] Figure 4B is a front view of the grab ring of Figure 4;

[0016] Figure 4C is a side cross-sectional view of the grab ring of Figure 4 taken along line 4C-4C of Figure 4;

[0017] Figure 5 is a perspective view of a third exemplary embodiment of a grab ring of the quick-connector according to an aspect of the disclosure;

[0018] Figure 5A is a top view of the grab ring of Figure 5;

[0019] Figure 5B is front view of the grab ring of Figure 5;

[0020] Figure 5C is a side cross-sectional view of the grab ring of Figure 5 taken along line 5C-5C of Figure 5;

[0021] Figure 5D is a back view of the grab ring of Figure 5;

[0022] Figure 6 is a perspective view of a release tool according to an aspect of the disclosure;

[0023] Figure 6A is a back view of the release tool of Figure 6;

[0024] Figure 6B is a front view of the release tool of Figure 6; and

[0025] Figure 6C is a side cross-sectional view of the release tool of Figure 6 taken along line 6C-6C of Figure 6.

DESCRIPTION OF THE ENABLING EMBODIMENTS

[0026] Referring to the figures, wherein like numerals indicate corresponding parts throughout the several views, a quick-connector **20** is generally shown for establishing fluid communication between a first pipe **22** and a second pipe **24**. It should be appreciated that the term “pipe” as used herein may encompass various types of pipes, tubes, conduits and the like. As best presented in Figures 1 and 1A, the quick-connector **20** includes a housing **26** that extends about and along a first axis **A** and includes a base segment **28**, a fitting segment **30**, and a shoulder segment **32**. The housing **26** further defines a bore **34** that extends axially therethrough. As will be explained in greater detail below, the first pipe **22** is connected to the housing **26** by being fitted about the fitting segment **30** and the second pipe **24** is connected to the housing **26** inside of the bore **34**.

[0027] As best shown in Figure 1A, the base segment **28** of the housing **26** is generally tube-shaped and extends axially between a first portion **36** and a second portion **38** and defines an inner surface **40** that partially defines the bore **34**. The inner surface **40** presents an annular ring seat **42** that extends radially inwardly toward the first axis **A** at the first portion **36**. The base segment **28** further defines a pair of generally rectangular-shaped locking channels **44** that extend radially inwardly into the bore **34** on diametrically opposite sides of the first axis **A** at an axial location that is adjacent to the second portion **38**. It should be appreciated that more or fewer locking channels **44** could be defined by the base segment **28** and the locking channels **44** could be positioned at other locations on the base segment **28** without departing from the scope of the subject disclosure.

[0028] The fitting segment **30** of the housing **26** is generally tube-shaped and extends axially from the first portion **36** of the base segment **28** for being received by the first pipe **22** for connecting the housing **26** to the first pipe **22**. A plurality of barbs **46** extend radially outwardly from the fitting segment **30** and annularly about the first axis **A** for frictionally securing the first pipe **22** to the fitting segment **30**. It should be appreciated that other types of connection mechanisms could be utilized to connect the housing **26** to the first pipe **22**. For example, as an alternative to utilizing the fitting segment **30** to connect to the first pipe **22**, an additional housing that is configured the same as housing **26** (without a fitting segment **30**) could be utilized. The additional housing could be integrally connected to, and extend away from first portion **36** of the base segment **28** of housing **26**.

[0029] The shoulder segment **32** of the housing **26** extends axially from the second portion **38** of the base segment **28**. The shoulder segment **32** is generally tube-shaped and has a larger diameter than the base segment **28**. It should be appreciated that the shoulder segment **32** could have other shapes and sizes without departing from the scope of the subject disclosure.

[0030] An o-ring **48** is disposed in the bore **34** in the base segment **28** and axially abuts the ring seat **42** for establishing a sealed relationship between the housing **26** and the second pipe **24** when the second pipe **24** is received within the the bore **34** of the housing **26**. Furthermore, a generally tube-shaped lock washer **50** is disposed in the bore **34** of the housing **26** about the first axis **A** at an axial location that is adjacent to the o-ring **48**. The lock washer **50** secures the o-ring **48** in place by blocking axial movement of the o-ring **48** relative to the housing **26**. A pair of tabs **52** extend radially outwardly from the lock washer **50** and are received by the locking channels **44** of the base segment **28** of the housing **26** for preventing axial movement of the lock washer **50** relative to the housing **26**. It should be appreciated that more or fewer tabs **52** could be utilized, and the tabs **52** could extend from

other locations of the lock washer **50** without departing from the scope of the subject disclosure.

[0031] As best illustrated in Figures 1 and 1A, a nose piece **53** extends about the first axis **A** and is removeably secured to the shoulder segment **32** of the housing **26**. The nose piece **53** has a cylinder portion **55** and a tapered portion **57**. The cylinder portion **55** is generally tube-shaped and is secured to the shoulder segment **32** of the housing **26**. In the exemplary embodiment, the cylinder portion **55** is secured to the shoulder segment **32** using a threaded connection, however, other attachment methods could be utilized such as, but not limited to, a snap-fit type connection without departing from the scope of the subject disclosure. The tapered portion **57** extends from the cylinder portion **55** and is tapered radially inwardly toward the first axis **A**. The nose piece **53** further defines an opening **59** that extends axially therethrough for receiving the second pipe **24**.

[0032] A grab ring **54, 154, 254** is disposed in the bore **34** in the shoulder portion of the housing **26** about the first axis **A**. The grab ring **54, 154, 254** includes a body **56** that has a generally tube shape and presents an outside surface **58** and an inside surface **60**. The body **56** extends axially between a first end **62** and a second end **64** with the first end **62** disposed adjacent to the second portion **38** of the base segment **28** of the housing **26**. The body **56** further defines a passage **66** that extends axially therethrough for receiving the second pipe **24**.

[0033] As best illustrated in Figure 1A, the inside surface **60** of the body **56** of the grab ring **54, 154, 254** presents an annular notch **68** that extends radially inwardly toward the first axis **A** at an axial location that is adjacent to the first end **62** of the body **56**. Furthermore, the inside surface **60** of the body **56** defines at least one detent **70** axially above the notch **68** that extends therein.

[0034] As further illustrated in figures 1A, the grab ring **54, 154, 254** also includes a tooth insert **72** that is connected to the body **56** inside the passage **66** of the body **56**. As best shown in Figure 2, the tooth insert **72** has a periphery **74** and a plurality of protrusions **76**. The periphery **74** is generally ring-shaped and includes an outer rim **78** and an inner rim **80**. With reference back to Figure 1A, the outer rim **78** is received by the detent **70** and is supported axially by the notch **68** of the body **56** of the grab ring **54, 154, 254**. In the exemplary embodiments, the plurality of protrusions **76** include at least three teeth **76** that extend from the inner rim **80** generally axially toward the first end **62** of the grab ring **54, 154, 254** and are tapered radially inwardly toward the first axis **A**. Once the second pipe **24** has been inserted into the passage **66** of the grab ring **54, 154, 254**, the teeth **76** of the tooth insert **72** clamp against the second pipe **24**. It should be appreciated that the periphery **74** of the tooth insert **72** could have other shapes without departing from the scope of the subject disclosure. It should further be appreciated that more protrusions **76** could be utilized and that the protrusions **76** could have various shapes and sizes without departing from the scope of the subject disclosure.

[0035] As best presented in Figure 1A, the body **56** of the grab ring **54, 154, 254** further presents a compression surface **102** at the second end **64** that tapers radially inwardly between the outside and inside surfaces **58, 60**. The compression surface **102** engages the tapered portion **57** of the nose piece **53** for forcing the body **56** to flex inwardly during axial movement of the grab ring **54, 154, 254** against the tapered portion **57** of the nose piece **53**. Such movement causes the teeth **76** to tighten about, i.e., “grab”, the second pipe **24** to prevent the second pipe **24** from being removed from the housing **26**. Said another way, the abutment of the tapered compression surface **102** and the tapered portion **57** of the nose piece **53** allows the teeth **76** of the tooth insert **72** to be tightened about the

second pipe **24** during axial pulling of the second pipe **24** away from the housing **26**, thereby preventing the second pipe **24** from being removed from the grab ring **54**.

[0036] As best presented in Figures 3, 4 and 5, the body **56** of the grab ring **54, 154, 254** includes a plurality of hinges **92, 94, 96** that are circumferentially spaced from one another about the body **56** for allowing the body **56** to flex circumferentially about the hinges **92, 94, 96** for tightening and loosening the body **56** about the second pipe **24**. It should be appreciated that having a plurality of spaced hinges **92, 94, 96** more uniformly distributes the clamping forces on the second pipe **24** by the plurality of protrusions **76**. This prevents scoring of the second pipe **24** during insertion of the second pipe **24** into the passage **66** of the body **56**, which is a known problem with prior art quick-connectors which utilize only a single hinge.

[0037] As best presented in Figure 2, the outer rim **78** of the periphery **74** of the tooth insert **72** defines a plurality of grooves **98** that extend radially inwardly from the outer rim **78** toward the inner rim **80**, each in alignment with one of the hinges **92, 94, 96**. A tooth pivot **100** is defined between each of the grooves **98** and the inner rim **80** of the periphery **74** for allowing the tooth insert **72** to flex circumferentially about the tooth pivots **100** with the body **56** during flexing of the body **56** about the hinges **92, 94, 96**, thereby aiding in uniformly distributing the clamping forces on the received pipe **24** by the plurality of protrusions **76**. Said another way, the tooth pivots **100** function the same as the hinges **92, 94, 96** of the body **56** and flex in synchronization with the hinges **92, 94, 96** to aid in uniformly distributing the clamping forces on the received pipe **24**. It should be appreciated that the grooves **98** could alternatively be defined by the inner rim **80** of the periphery **74** or by both the outer and inner rims **78, 80**.

[0038] In the exemplary embodiments, the tooth insert **72** is made of a metal material and the grab ring **54, 154, 254** is made of an organic polymer material. Further, the

grab ring **54, 154, 254** is overmolded about the periphery **74** of the tooth insert **72**. It should be appreciated that other materials could be utilized and other molding / manufacturing techniques can be used to form the tooth insert **72** and grab ring **54, 154, 254** without departing from the scope of the subject disclosure.

[0039] As best presented in Figures 3-3B, in the first exemplary embodiment of the grab ring **54** the body **56** defines a plurality of arc-shaped niches **114** that each extend radially inwardly from the outside surface **58** and are circumferentially spaced from one another. In the presented arrangement, the plurality of hinges **92** includes three niche hinges **92** that are each disposed between the inside surface **60** of the body **56** and one of the niches **114**. It should be appreciated that the niches **114** could alternatively be defined by the inside surface **60** of the body **56**, thus defining the niche hinges **92** between the outside surface **58** and the niches **114**. Further, the niches **114** could be defined by a combination of the outside and inside surfaces **58, 60** of the body **56**. The body **56** of the grab ring **54** further defines a generally rectangular-shaped gap **112** that extends radially through the body **56** for providing space to allow the body **56** to flex inwardly at the gap **112**.

[0040] As best presented in Figures 4-4C, in the second exemplary embodiment of the grab ring **154** a plurality of gaps **112** are defined by the body **56** and separate the body into a plurality of members **116, 118**. In the presented arrangement, the plurality of gaps **112** include a pair of gaps **112** on diametrically opposite sides of the first axis **A** that separate the grab ring **154** into a first member **116** and a second member **118**, with the first and second members **116, 118** being mirror images of one another. The plurality of hinges **94** includes a plurality of biasing hinges **94** that extend between the plurality of members **116, 118** in each of the gaps **112**. As best shown in Figure 4A, each of the biasing hinges **94** comprises a spring of metal material and is shaped to include at least one peak **120** and at least one valley **122**, however, it should be appreciated that the biasing hinges **94** could be

made of other materials and could take other shapes without departing from the scope of the subject disclosure. It should further be appreciated that more or fewer biasing hinges **94** could be utilized without departing from the scope of the subject disclosure.

[0041] As best presented in Figures 5-5D, in a third exemplary embodiment of the grab ring **254**, the body **56** of the grab ring **254** defines a plurality of slots **124** that each extend axially from the first end **62** of the grab ring **254** and divide the body into a plurality of components **126, 128**. In the presented arrangement, the plurality of slots **124** includes a pair of slots **124** on diametrically opposite sides of the first axis **A** and divide the body **56** into a first component **126** and a second component **128**, with the first and second components **126, 128** being mirror images of one another. Each of the slots **124** are defined by a pair of linear portions **130** that extend axially in spaced and parallel relationship with one another, and an arc portion **132** that extends between the linear portions **130** adjacent to the second end **64** of the grab ring **254**. The plurality of hinges **96** includes a plurality of mouth hinges **96**, each defined between the second end **64** of the body **56** and one of the arc portions **132**. The mouth hinges **96** allow the components **126, 128** of the body **56** to pivot toward and away from one another about the mouth hinges **96**. Said another way, the mouth hinges **96** allow the linear portions **130** of the slots **124** to pivot toward and away from one another during pivoting about the mouth hinge **96**.

[0042] With reference to Figures 6-6D, a release tool **104** is configured to mate with the second pipe **24** for releasing the second pipe **24** from the passage **66** of the grab ring **54** while preventing the teeth **76** from damaging the second pipe **24** during removal of the second pipe **24** from the passage **66**. The release tool **104** includes a generally C-shaped foundation portion **106** that defines an aperture **108** that extends along a tool axis **B**. The release tool **104** further includes a pair of arc-shaped projections **110** that extend parallel to the tool axis **B** from the foundation portion **106**, about the aperture **108** for being clamped

about the first pipe **22** or second pipe **24**. This clamping shields the first or second pipe **22**, **24** from the protrusions **76** during removal of the first or second pipe **22**, **24** from the passage **66**. It should be appreciated that the foundation portion **106** and projections **110** could have other shapes without departing from the scope of the subject disclosure.

[0043] 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 quick-connector for establishing fluid communication between a first pipe and a second pipe including:

a housing extending about and along a first axis and defining a bore extending axially therethrough;

a grab ring disposed in said bore of said housing and including a body extending about and along said first axis between a first end and a second end and defining a passage extending between said first and second ends for receiving one of the first or second pipes;

a plurality of protrusions extending from said body and into said passage for clamping against the received pipe to prevent the received pipe from being axially removed from said passage; and

a plurality of hinges spaced from one another about said body for allowing said body to flex circumferentially about said hinges when the first or second pipe is received in said passage to more uniformly distribute the clamping forces on the received pipe by said plurality of protrusions.

Claim 2. A quick-connector as set forth in claim 1 wherein said body presents an outside surface and an inside surface facing said first axis, said outside surface defines a plurality of niches extending radially inwardly and having an arc shape, and said plurality of hinges includes a plurality of niche hinges each disposed between said inside surface of said body and one of said niches.

Claim 3. A quick-connector as set forth in claim 2 wherein said plurality of niches include three niches spaced from one another about said outside surface of said body,

and said plurality of hinges includes three niche hinges each disposed between said inside surface of said body and one of said three niches.

Claim 4. A quick-connector as set forth in claim 3 wherein said body defines at least one gap extending therethrough between said inside and outside surfaces and spaced from said niches to provide space for said body to move within said gap during said circumferential flexing.

Claim 5. A quick-connector as set forth in claim 1 wherein said body defines a plurality of gaps separating said grab ring into a plurality of members, and said plurality of hinges includes at least one biasing hinge extending between said members in each of said gaps.

Claim 6. A quick-connector as set forth in claim 5 wherein said plurality of gaps includes a pair of gaps separating said grab ring into a first member and a second member.

Claim 7. A quick-connector as set forth in claim 6 wherein said pair of gaps are defined on diametrically opposite sides of said first axis to define said first and second members each being mirror images of one another.

Claim 8. A quick-connector as set forth in claim 5 wherein said at least one biasing hinge in each of said gaps includes a pair of biasing hinges in spaced relationship with one another.

Claim 9. A quick-connector as set forth in claim 5 wherein each of said biasing hinge comprises a spring of metal material being shaped to include at least one peak and at least one valley and biasing said first and second members toward one another.

Claim 10. A quick-connector as set forth in claim 1 wherein said body defines a plurality of slots extending from said first end toward said second end to divide said body into a plurality of components, each of said slots includes a pair of linear portions extending in spaced relationship with one another and an arc portion extending between said linear portions adjacent to said second end of said grab ring, and said plurality of hinges includes a plurality of mouth hinges each disposed between said second end of said body and one of said arc portions.

Claim 11. A quick-connector as set forth in claim 10 wherein said plurality of slots includes a pair of slots on diametrically opposite sides of said first axis, and said plurality of components includes a first component and a second component being mirror images of one another.

Claim 12. A quick-connector as set forth in claim 10 wherein said linear portions extend axially and in parallel relationship with one another.

Claim 13. A quick-connector as set forth in claim 1 further including a tooth insert disposed in said passage of said body having a periphery connected to said inner surface of said body, and said plurality of protrusions extending inwardly from said periphery.

Claim 14. A quick-connector as set forth in claim 13 wherein said periphery extends annularly and said plurality of protrusions comprises at least three teeth being spaced circumferentially from one another about said periphery.

Claim 15. A quick-connector as set forth in claim 14 wherein said teeth extend generally axially toward said first end of said body and are tapered radially inwardly toward said first axis.

Claim 16. A quick-connector as set forth in claim 13 wherein said inner surface of said body further defines at least one detent extending radially outwardly, and said outer rim of said periphery is received by said at least one detent of said body to secure said tooth insert to said grab ring.

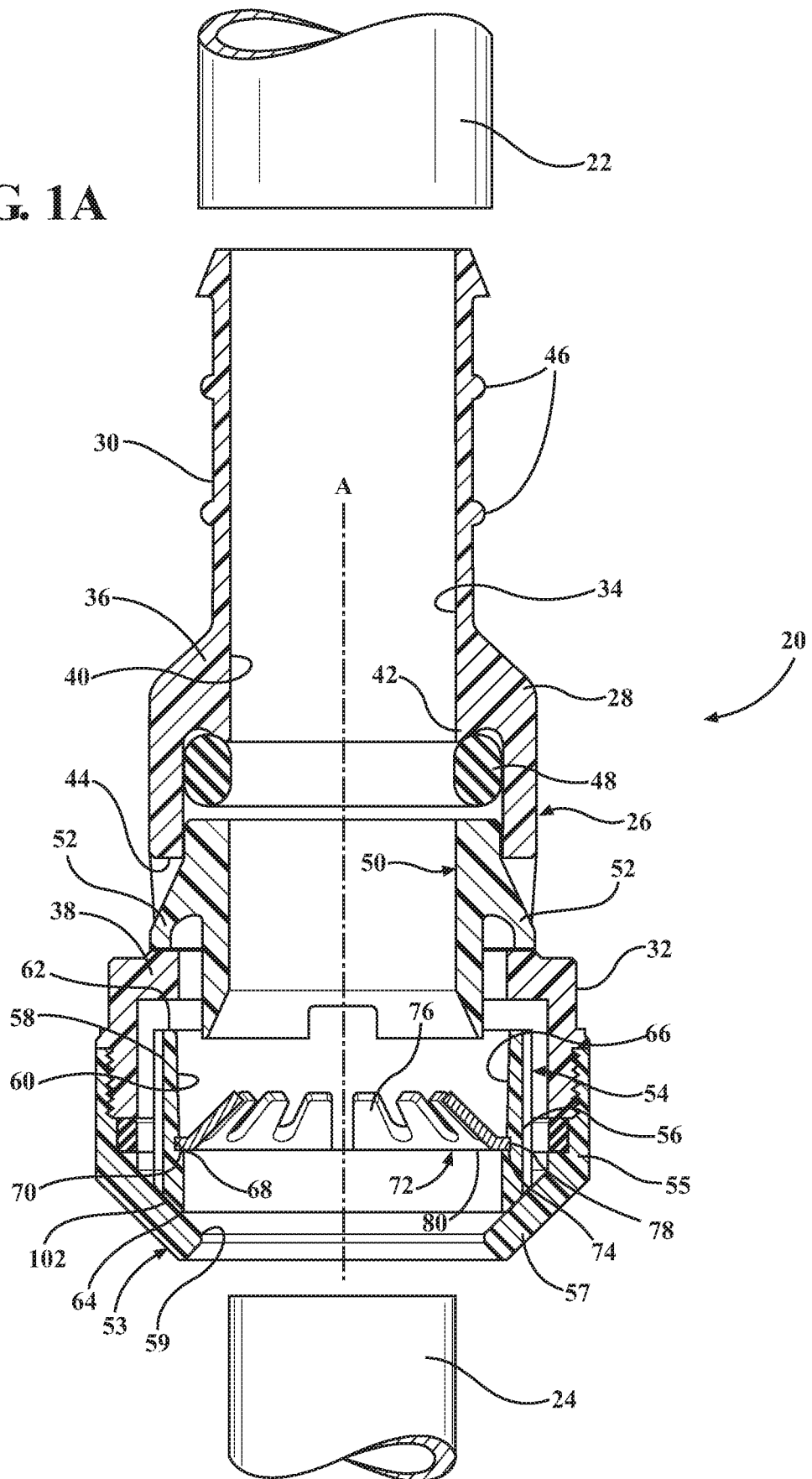
Claim 17. A quick-connector as set forth in claim 13 wherein said outer rim of said periphery defines a plurality of grooves extending toward said inner rim each in alignment with one of said hinges to define a plurality of tooth pivots each between one of said grooves and said inner rim of said periphery for allowing said tooth insert to flex circumferentially about said tooth pivots with said body during flexing of said body about said hinges to aid in uniformly distributing the clamping forces on the received pipe by said plurality of protrusions.

Claim 18. A quick-connector as set forth in claim 1 further including a release tool configured to mate with the first or second pipe and release the first or second pipe from said passage of said grab ring while preventing said plurality of protrusions from damaging the first or second pipe.

Claim 19. A quick-connector as set forth in claim 18 wherein said release tool includes a foundation portion defining an aperture extending along a tool axis, and said release tool further includes a pair of projections extending parallel to said tool axis from said foundation portion about said aperture for being clamped about the first or second pipe to shield the first or second pipe from said plurality of protrusions during removal of the first or second pipe from said passage of said grab ring.

Claim 20. A quick-connector as set forth in claim 1 further including a nose piece connected to said housing and presenting a tapered portion tapering radially inwardly toward said first axis, said body further presenting a compression surface at said second end tapering radially inwardly in engaging relationship with said tapered portion of said nose piece for forcing said body to flex inwardly at said plurality of hinges during axial movement of said grab ring against said tapered portion to tighten said plurality of protrusions about the received pipe and to prevent the received pipe from being removed from said passage of said body.

FIG. 1A



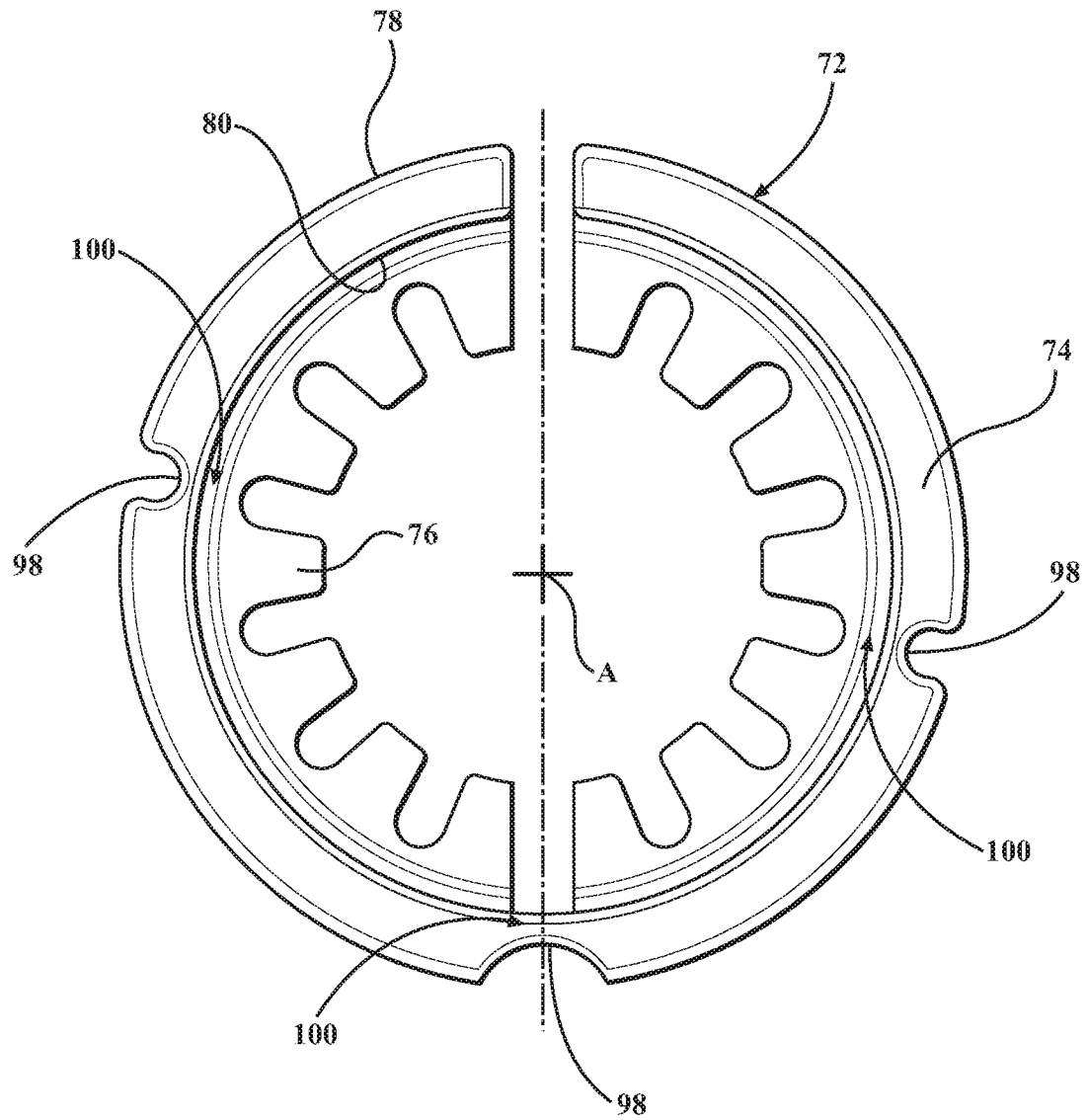
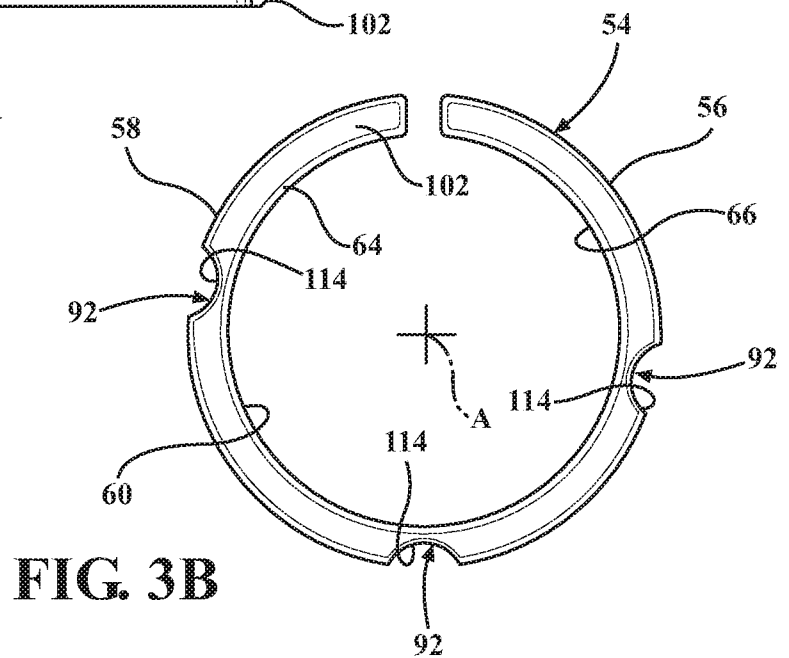
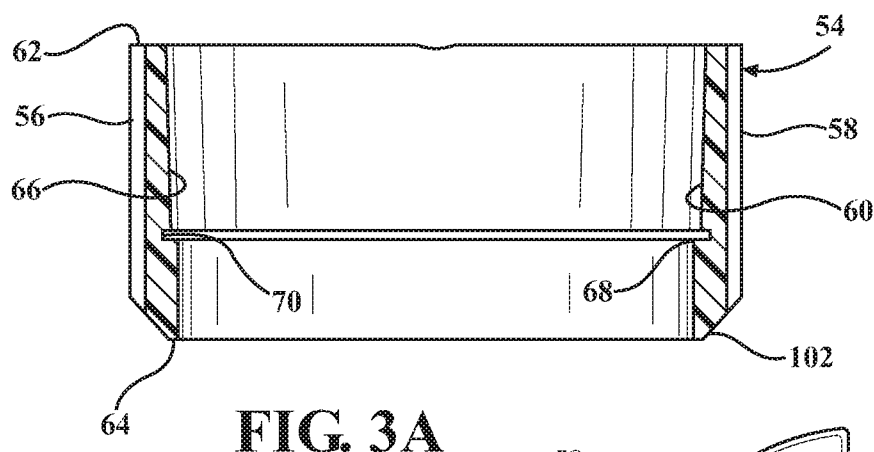
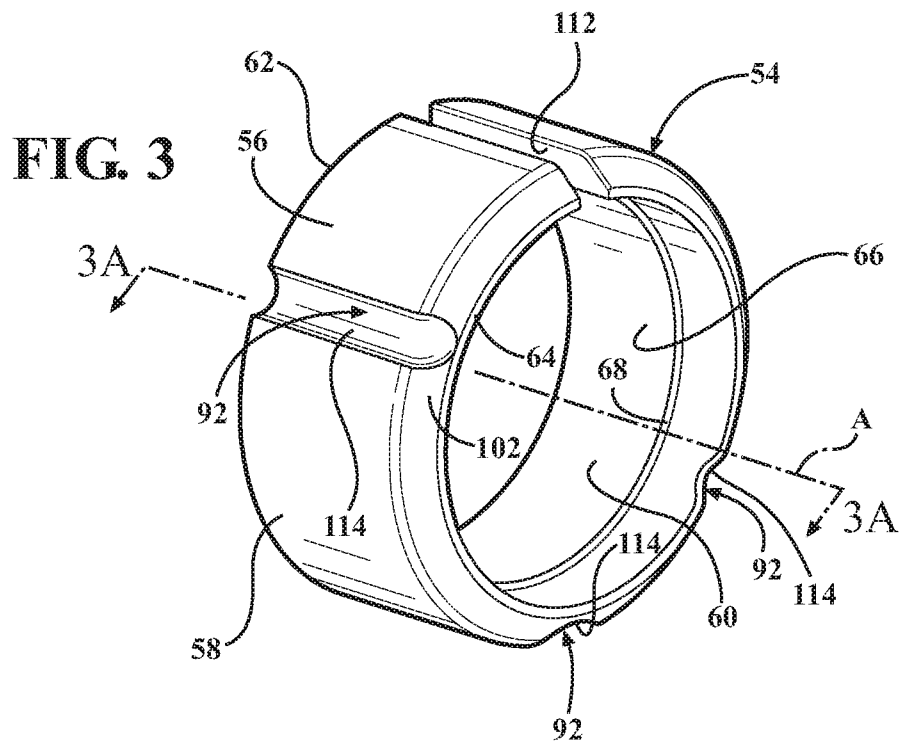
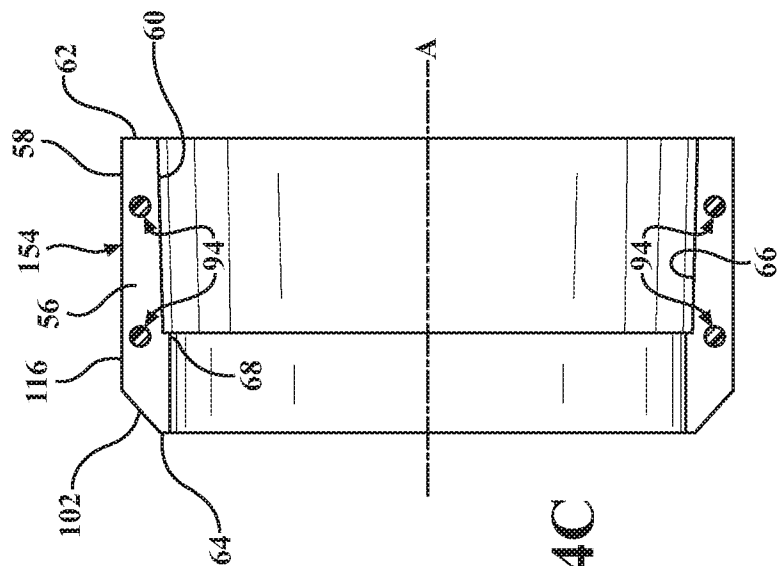
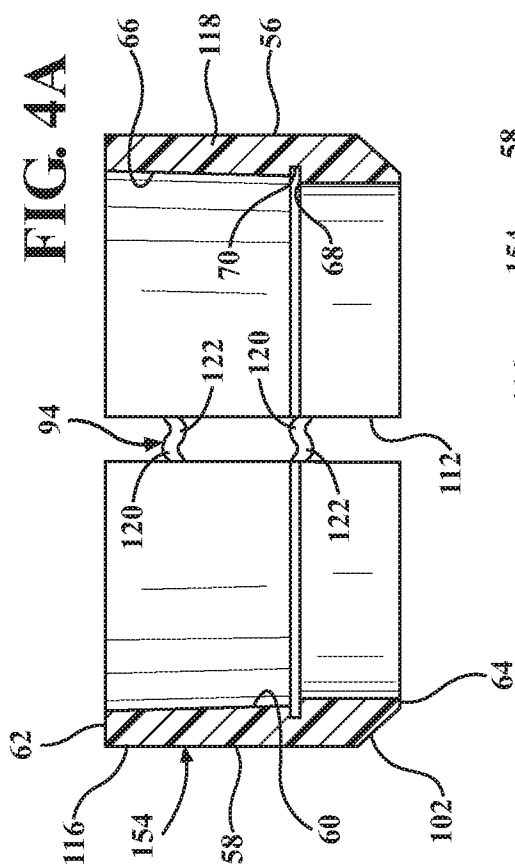
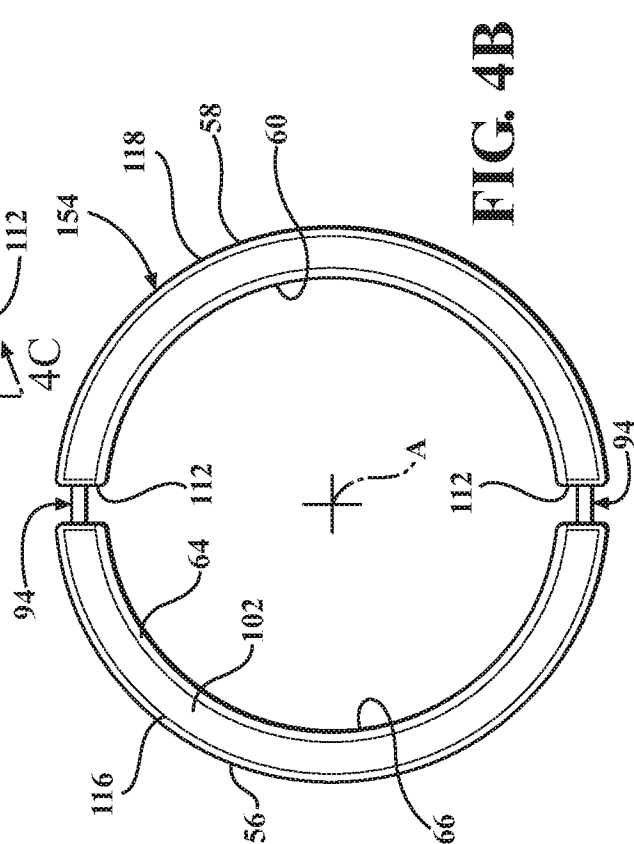
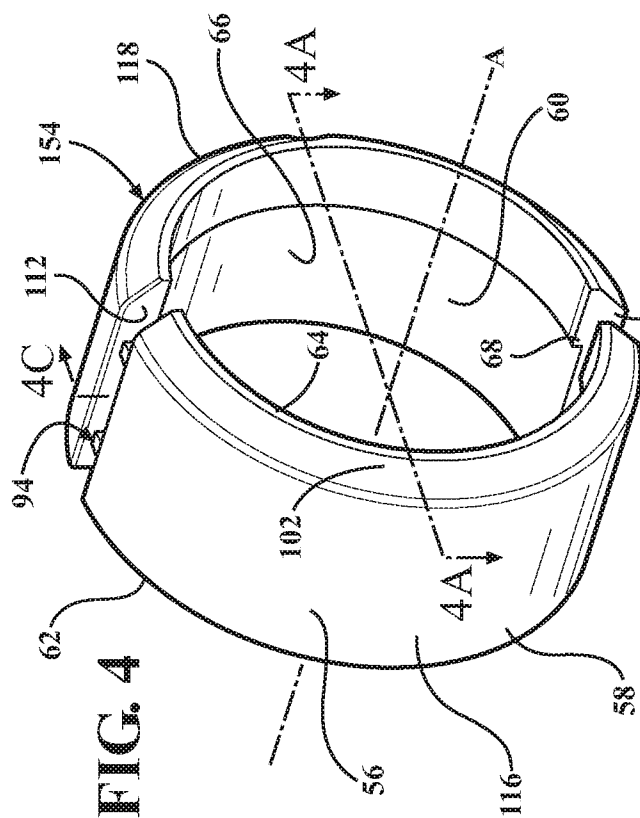
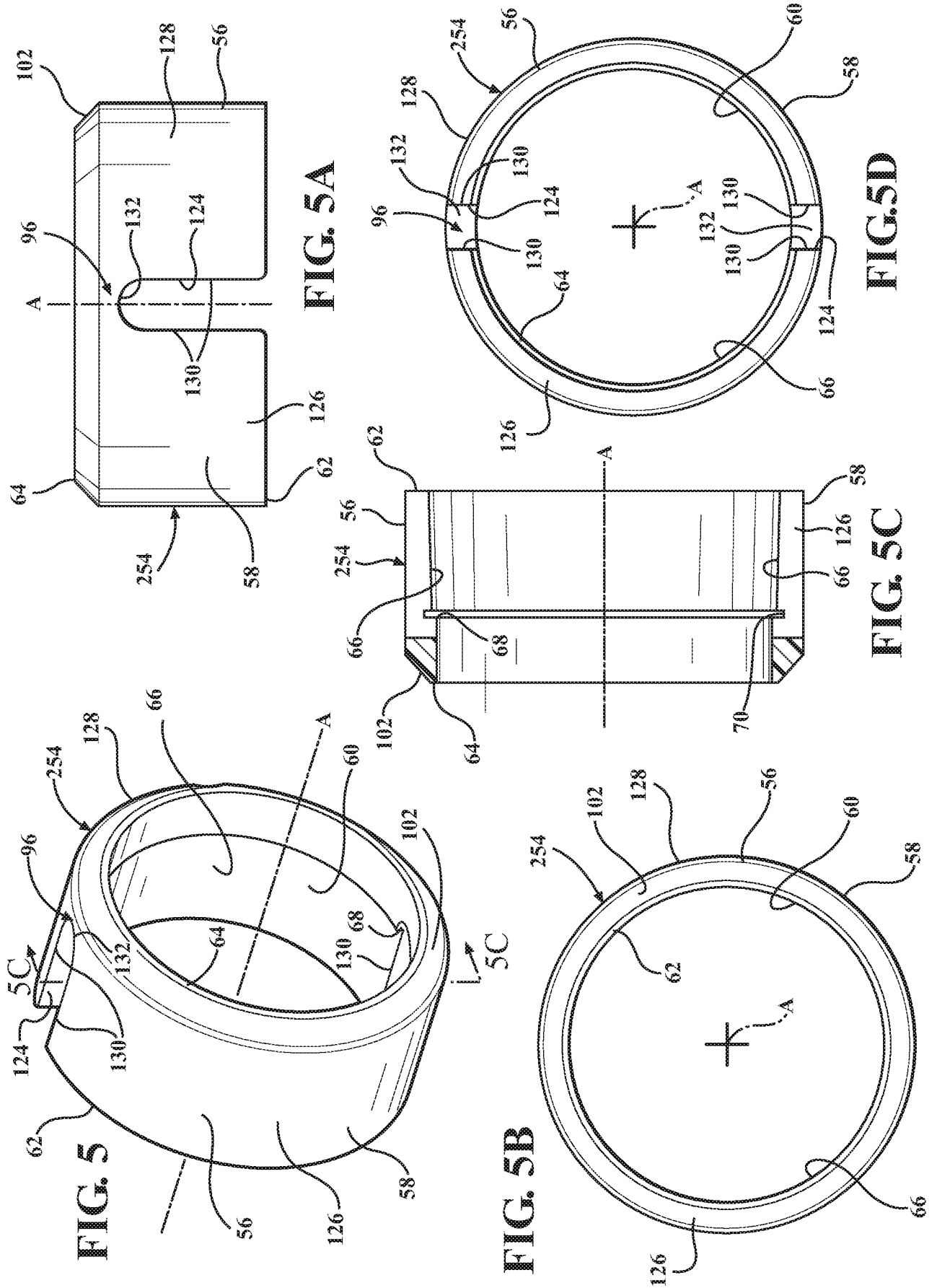


FIG. 2







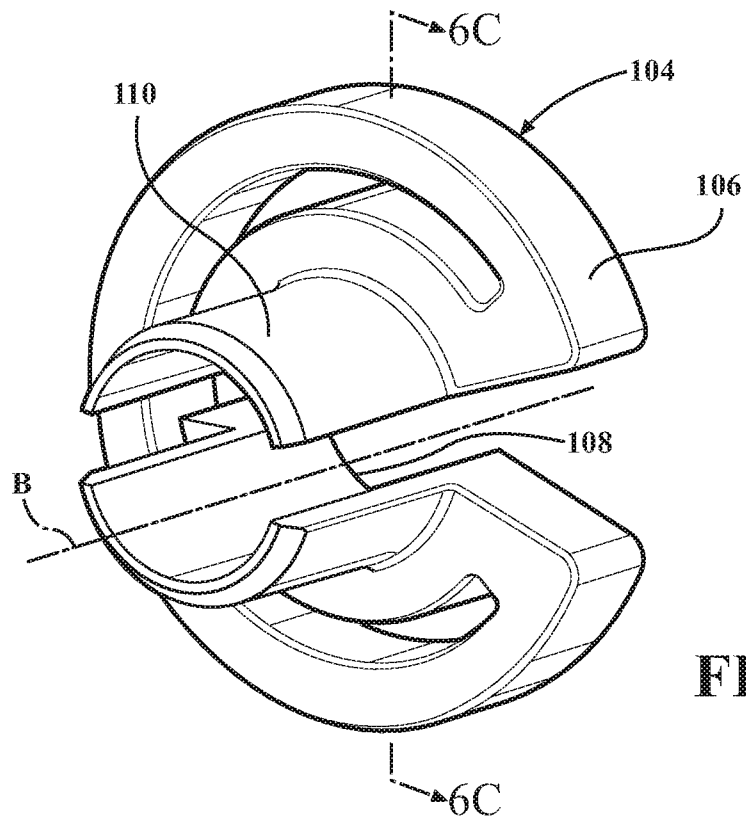


FIG. 6

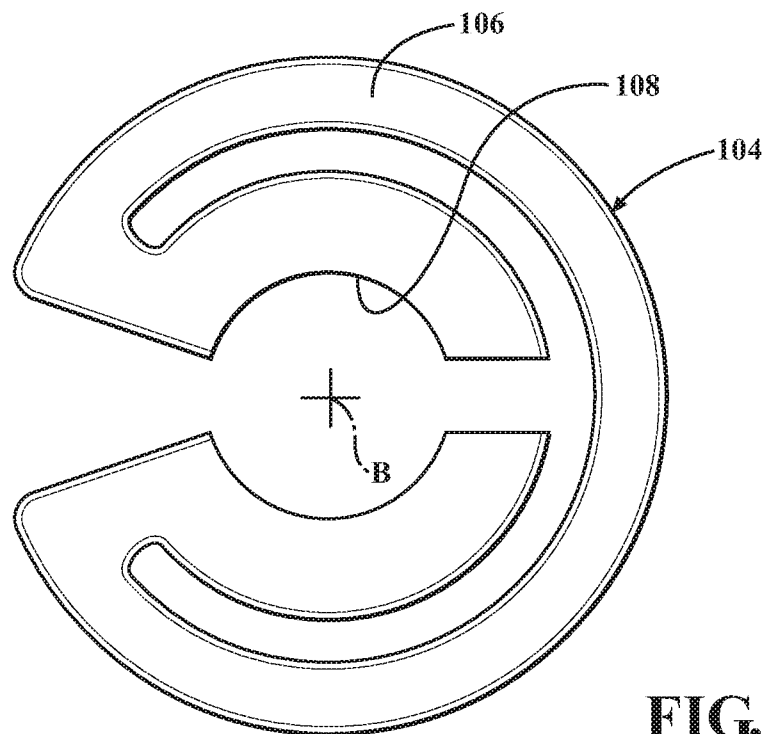


FIG. 6A

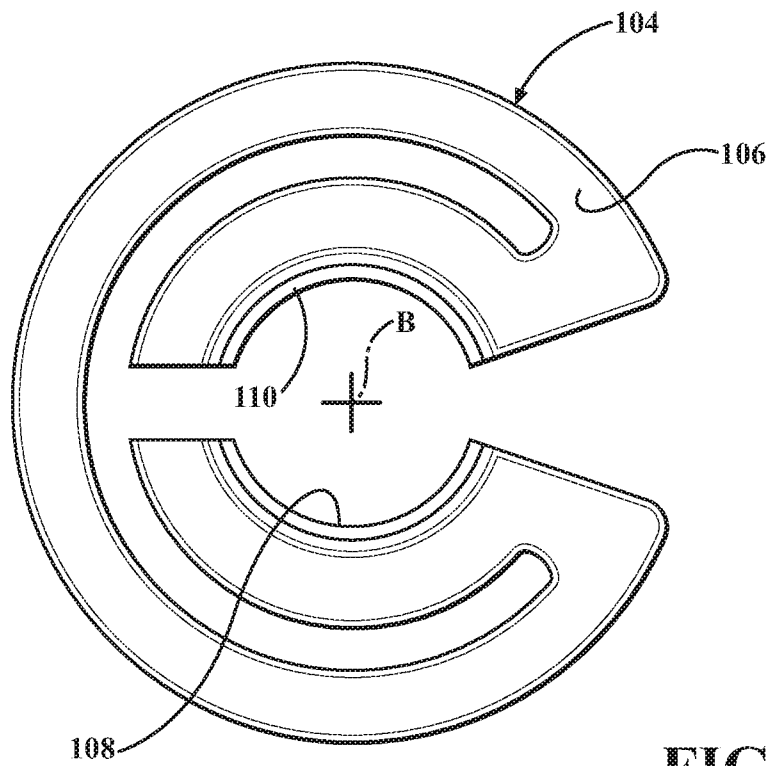


FIG. 6B

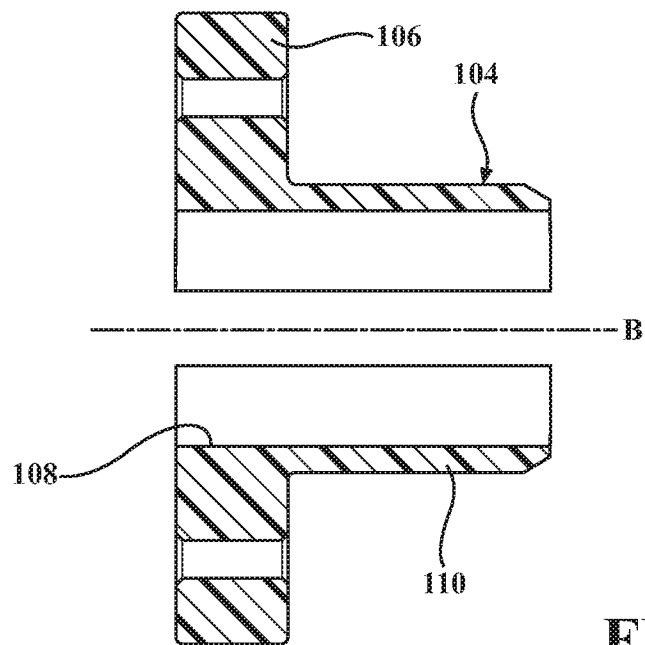


FIG. 6C

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/36616

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - F16L 37/088, F16L 37/091, F16L 37/084, F16L 37/08, F16L 37/00 (2016.01)

CPC - F16L 37/088, F16L 37/091, F16L 37/0915, F16L 37/084, F16L 37/08, F16L 37/00

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)

IPC(8): F16L 37/* (2016.01)

CPC: F16L 37/*

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

IPC(8): F16L* (2016.01)

CPC: F16L*

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

PatBase, Google Patents, Google Web

Keywords: gasket, seal, ring, hinge, thread, screw, tool, release, removal, two, pipes, conduits, tubes, between, lutzke matthew, geist richard, hunt mitchell, rayment et cie, gap, slot, slit, ring, annular, fluid, grip

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y -- A	WO 97/03314 A1 (MARLEY EXTRUSIONS LTD) 30 January 1997 (30.01.1997), entire document	1, 13-16, 18-20 ----- 2-4 ----- 8-12, 17
Y -- A	✓ EP 0304346 A2 (SOCIETE GIRPI) 22 February 1989 (22.02.1989), entire document	1, 5-7 ----- 8-12, 17
Y	US 1,440,207 A (BURNS) 26 December 1922 (26.12.1922), entire document	2-4
Y -- A	US 2,585,453 A (GALLAGHER et al.) 12 February 1952 (12.02.1952), entire document	1, 5-7 ----- 8-12, 17
A	US 5,779,284 A (GUEST) 14 July 1998 (14.07.1998), entire document	10-12



Further documents are listed in the continuation of Box C.



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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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

22 August 2016

Date of mailing of the international search report

09 SEP 2016

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/36616

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,957,509 A (KOMOLROCHANAPORN) 28 September 1999 (28.09.1999), entire document	1-20
A	US 5,603,532 A (GUEST) 18 February 1997 (18.02.1997), entire document	1-20
A	US 2,755,109 A (RISLEY) 17 July 1956 (17.07.1956), entire document	1-20
A	WO 00/36327 A1 (ACCOR TECHNOLOGY, INC) 22 June 2000 (22.06.2000), entire document	1-20
A	CN 201237049 Y (YUEQIANG) 13 May 2009 (13.05.2009), entire document	1-20