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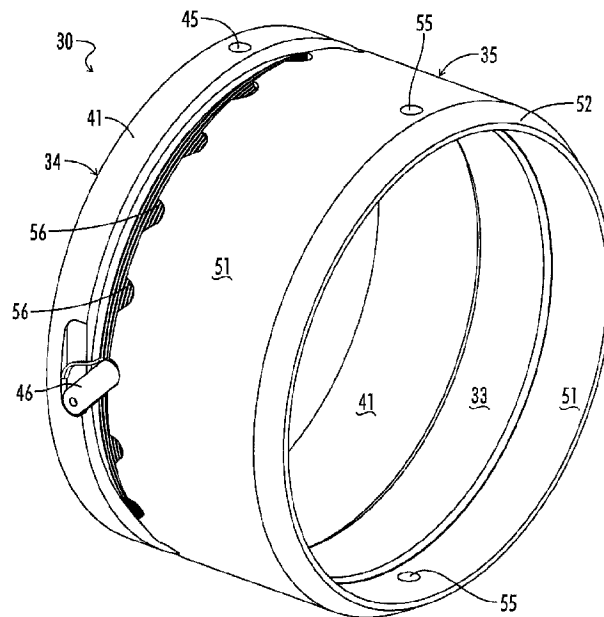
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(54) **Title: STOP COLLAR**



(57) **Abrégé/Abstract:**

Stop collars may be fixedly mounted on a liner or other tubular member. The stop collar comprises a first sleeve and a second sleeve. The sleeves are adapted to extend around the outer circumference of the tubular member and are engaged by threaded connections. The sleeves provide opposing inner thrust surfaces. The collar further comprises a radially expandable gripping member disposed between the opposing thrust surfaces. The sleeves may be drawn together by rotation about the threaded connection to cause the thrust surfaces to bear on the gripping member and expand the gripping member radially inward into frictional engagement with the tubular member.

ABSTRACT

Stop collars may be fixedly mounted on a liner or other tubular member. The stop collar comprises a first sleeve and a second sleeve. The sleeves are adapted to extend around the outer circumference of the tubular member and are engaged by threaded connections. The sleeves provide opposing inner thrust surfaces. The collar further comprises a radially expandable gripping member disposed between the opposing thrust surfaces. The sleeves may be drawn together by rotation about the threaded connection to cause the thrust surfaces to bear on the gripping member and expand the gripping member radially inward into frictional engagement with the tubular member.

STOP COLLAR

FIELD OF THE INVENTION

The present invention relates to downhole tools used in oil and gas well drilling operations and, and more particularly, to tool assemblies and stop collars that may be mounted on a liner or other tubular used in oil and gas wells.

BACKGROUND OF THE INVENTION

Hydrocarbons, such as oil and gas, may be recovered from various types of subsurface geological formations. The formations typically consist of a porous layer, such as limestone and sands, overlaid by a nonporous layer. Hydrocarbons cannot rise through the nonporous layer. Thus, the porous layer forms a reservoir, that is, a volume in which hydrocarbons accumulate. A well is drilled through the earth until the hydrocarbon bearing formation is reached. Hydrocarbons then are able to flow from the porous formation into the well.

In what is perhaps the most basic form of rotary drilling methods, a drill bit is attached to a series of pipe sections or "joints" referred to as a drill string. The drill string is suspended from a derrick and rotated by a motor in the derrick. A drilling fluid or "mud" is pumped down the drill string, through the bit, and into the bore of the well. This fluid serves to lubricate the bit. The drilling mud also carries cuttings from the drilling process back to the surface as it travels up the wellbore. As the drilling progresses downward, the drill string is extended by adding more joints of pipe.

A modern oil well typically includes a number of tubes extending wholly or partially within other tubes. That is, a well is first drilled to a certain depth. Large diameter pipes, or casings, are placed in the well and cemented in place to prevent the sides of the borehole from caving in. After the initial section has been drilled, cased, and cemented, drilling will proceed with a somewhat smaller wellbore. The smaller bore is lined with somewhat smaller pipes or "liners." The liner is suspended from the original or "host" casing by an anchor or "hanger." A well may include a series of smaller liners, and may extend for many thousands of feet, commonly up to and over 25,000 feet.

The liners are cemented in the wellbore as the well is constructed. That is, the liner necessarily is smaller than the bore in which it is installed. The gap between the liner and the wellbore is referred to as the annulus, and it is filled with cement after the

1 liner has been installed. The cement helps secure the liner in the wellbore and protect it
2 against corrosion and erosion. It also supports the borehole walls from collapse. If
3 fluids will be produced through the liner, cement also helps ensure more precise control
4 over stimulation processes, such as fracturing and acidizing.

5 Most importantly, the cement is intended to form a continuous sheath, that is, a
6 complete seal around the liner. If the liner leaks, the cement sheath will help ensure that
7 fluids flowing through the liner do not contaminate the surrounding formation, and
8 especially water-bearing formations. The cement sheath also ensures that hydrocarbons
9 and other fluids in the formation are not able to migrate to other parts of the formation or
10 to the surface.

11 The liner is cemented in the wellbore by injecting a cementitious, settable slurry
12 down the liner and allowing it to flow up the annulus. The cement then is allowed to set,
13 that is, solidify and harden into what hopefully will be a continuous seal throughout the
14 annulus. There are a number of challenges, however, in ensuring that the sheath is
15 continuous and that a complete seal is established between the bore and liner. Some
16 issues arise from the chemical and physical nature of the cement slurry and how it
17 interacts with other fluids in the well or the formation. The position of a liner in the bore
18 also can create significant impediments to forming a complete seal.

19 That is, oil wells are commonly depicted as extending straight down into the earth
20 with a tube running right down the middle of the bore. The truth is far from that.
21 Because it is formed with a rotating drill bit, the bore will tend to corkscrew as it is
22 extended. Moreover, in order to increase production, the bore commonly will be deviated
23 from a nominal vertical bearing to extend it along, rather than through a hydrocarbon-
24 bearing formation. So-called "horizontal" wells constitute most of the wells being drilled
25 in the United States today.

26 A liner, therefore, will not necessarily be centered within a wellbore. It may tend
27 to rest against the side of a bore, especially in horizontal extensions. A cement slurry
28 may not be able to flow into the area where a liner rests against the borehole. Thus, when
29 set, voids may be left in the cement sheath, or it may have thin, weak portions. Fluids
30 from the formation may be able to migrate from one area of the formation to another or
31 may even reach the surface.

1 In an effort to mitigate such problems, a liner typically will be provided with
2 centralizers. The centralizers are intended to maintain a minimum clearance between the
3 liner and the bore, while at the same time providing paths which allow cement slurry to
4 flow past them. “Bow-spring” centralizers are one common type of centralizer. They
5 have a pair of relatively short sleeves that fit around the outside of a liner. A number of
6 relatively stiff, narrow bow springs extend between the sleeves. The bow springs curve
7 away from the liner and keep the liner spaced from the walls of the bore. The springs are
8 spaced angularly around the circumference of the sleeves so that cement slurry can flow
9 around and through the centralizer.

10 “Spiral-blade” centralizers are another common type. They incorporate a single
11 longer sleeve. The sleeve has raised, rounded blades that extend along the sleeve in a
12 loose helix. The blunt blades maintain clearance with the bore while providing channels
13 through which cement may flow. Centralizers, therefore, can greatly reduce or eliminate
14 contact between a liner and the bore, and help ensure that the cement sheath will have
15 sufficient thickness throughout the annulus to provide an effective seal.

16 Centralizers may be mounted on a liner in a fixed position. For example, U.S.
17 Pat. Pub. No. 2013/0160993 of J. Davilla *et al.* discloses a spiral-blade centralizer that is
18 fixedly mounted on a liner. It generally comprises a body and a pair of wedge rings. The
19 body is generally cylindrical and fits around a liner. Blunt blades are provided around its
20 circumference to keep the liner spaced from the bore and provide channels for cement
21 flow. Each end of the centralizer body has internal threads. The threads are opposed.
22 That is, the threads on one end of the body are right-hander and those at the other end are
23 left-handed. The internal threads on the body engage external threads on a tapered
24 surface of the wedge rings. Thus, the body may be rotated to draw the wedge rings
25 together. As they draw together, teeth on the inner surface of the wedge rings bite into
26 the liner, securing the centralizer in place.

27 Providing a centralizer with some freedom of movement, however, can make it
28 much easier to run a liner into a well. Thus, other centralizers, including bow-spring and
29 spiral-blade type centralizers, are mounted such that they are free to rotate and travel a
30 certain distance along a liner. Sliding centralizers are widely available on the market,
31 including slip-on bow-spring and spiral-blade centralizers distributed by Top-Co,

1 Houston, Texas, and MSIS-B bow spring centralizers available from Weatherford.
2 Movement of the centralizer along a liner will be limited by what are referred to as thrust
3 or stop collars. A stop collar will be placed above and below the centralizer as a joint of
4 liner is run into the well. The stop collars are securely mounted to the liner to provide
5 mechanical stops limiting travel of the centralizer along the liner.

6 Stop collars may simply comprise a collar which is slid on a liner and secured in
7 place with set screws. Other designs utilize a hinged collar or a split collar. The collar is
8 opened to place it around a liner. The ends then are brought together and latched or
9 otherwise secured. Such designs may have metal gripping features which bite into the
10 liner, or they may have an elastomeric layer concentrically disposed within the collar.
11 Some designs incorporate both metal gripping features and elastomers, such as the stop
12 collars disclosed in U.S. Pat. 3,652,138 to C. Collett. Other designs rely on a layer of
13 swellable elastomer disposed on the inside surface of the collar, such as those disclosed
14 in U.S. Pat. 7,942,199 to P. Angman. The collar is dipped into an activating solution and
15 then slipped onto the liner. The elastomer swells and grips the liner.

16 The statements in this section are intended to provide background information
17 related to the invention disclosed and claimed herein. Such information may or may not
18 constitute prior art. It will be appreciated from the foregoing, however, that there
19 remains a need for new and improved systems and apparatus for mounting stop collars
20 and other tool assemblies in a fixed position on liners and other tubular members. Such
21 disadvantages and others inherent in the prior art are addressed by various aspects and
22 embodiments of the subject invention.

23 SUMMARY OF THE INVENTION

24 The subject invention, in its various aspects and embodiments, relates generally to
25 assemblies and stop collars that may be mounted in a fixed position on tubular members,
26 such as liners, that are used in oil and gas wells. It encompasses various embodiments
27 and aspects, some of which are specifically described and illustrated herein.

28 One broad embodiment of the subject invention provides a collar for mounting on
29 a tubular member. The collar comprises a first member and a second member. The two
30 members are adapted for lateral displacement relative to each other and provide opposing
31 inner thrust surfaces. The collar also comprises a radially expandable gripping member

1 which is disposed between the opposing thrust surfaces. The members may be drawn laterally
2 together to cause the thrust surfaces to bear on the gripping member. As the thrust surfaces
3 bear on the gripping member that will expand it radially inward into frictional engagement
4 with the tubular member.

5 Other broad embodiments and aspects are directed to a collar that is mountable on a
6 tubular member. The collar comprises a first sleeve and a second sleeve. The two sleeves are
7 adapted to extend around the outer circumference of the tubular member. The sleeves are
8 engaged with each other by threaded connections and provide opposing inner thrust surfaces.
9 The collar also comprises a radially expandable gripping member which is disposed between
10 the opposing thrust surfaces. The sleeves may be drawn together by rotating them relative to
11 each other about the threaded connection. The relative rotation will cause the thrust surfaces
12 to bear on the gripping member and expand the gripping member radially inward into
13 frictional engagement with the tubular member.

14 In other aspects, the invention provides for such collars where the gripping member
15 engages the tubular member without penetrating the member, where it engages the tubular
16 member without creating electrolytic contact between the collar and tubular member, or where
17 it engages the tubular member without penetration and without creating electrolytic contact.

18 Other aspects are directed to such collars where the first sleeve is provided with
19 external threads engaging internal threads on the second sleeve and the gripping member is
20 disposed between the inner end of the first sleeve and an annular shoulder in the second
21 sleeve. Still other embodiments are directed to such collars where the second sleeve provides
22 radial support for the gripping member. Yet other embodiments provide such collars where
23 the gripping member is carried in an expanded diameter portion of the second sleeve.

24 Additional embodiments and aspects provide such collars where the gripping member
25 is a compressible band, preferably an elastomer band.

26 In still other embodiments, the invention provides such collars having a mechanism to
27 restrict loosening of the threaded engagement between the sleeves. In some embodiments, the
28 mechanism comprises a pawl on one sleeve and detents angularly spaced along the inner end
29 of the other sleeve. The pawl selectively engaging the detents to restrict loosening of the
30 threaded engagement between the sleeves. In other embodiments, the mechanism is a set
31 screw extending through one sleeve and frictionally engaging the other sleeve.

1 The subject invention also is directed to stop collars and other tools for mounting on a
2 tubular. Broad embodiments of the novel tools comprise a novel collar. Other broad
3 embodiments are directed to a centralizing assembly. The assembly comprises a centralizer
4 tool. The centralizer tool comprises spacing members which extend radially outward beyond
5 the tubular member and define lateral channels. The assembly further comprises a novel stop
6 collar. Still other broad embodiments are directed to tubular assemblies. The tubular
7 assemblies comprise a novel centralizing assembly or other novel tool.

8 The subject invention also provides novel methods for conducting well operations.
9 Such methods include methods for centralizing liners or other tubulars in a well. The methods
10 comprise installing a novel centralizing assembly on the tubular and running the tubular into
11 the well.

12 The subject invention also is directed to a collar for mounting on a tubular member,
13 said mountable collar comprising: (a) a first sleeve and a second sleeve, said sleeves: i) being
14 adapted to extend around the outer circumference of said tubular member; ii) being engaged
15 by threaded connections; and iii) providing opposing inner thrust surfaces; (b) a radially
16 expandable gripping member disposed between said opposing thrust surfaces; (c) wherein said
17 sleeves are capable of being drawn together by rotation about said threaded connection to
18 cause said thrust surfaces to bear on said gripping member and expand said gripping member
19 radially inward into frictional engagement with said tubular member.

20 The subject invention also is directed to a collar for mounting on a tubular member,
21 said mountable collar comprising: (a) a first member and a second member, said members
22 being: i) adapted for lateral displacement relative to each other; and ii) providing opposing
23 inner thrust surfaces; and (b) a radially expandable gripping member disposed between said
24 opposing thrust surfaces; (c) wherein said members are capable of being drawn laterally
25 together to cause said thrust surfaces to bear on said gripping member and expand said
26 gripping member radially inward into frictional engagement with said tubular member,
27 (d) wherein said gripping member engages said tubular member without penetrating said
28 tubular member.

29 Finally, still other aspects and embodiments of the invention will have various
30 combinations of such features as will be apparent to workers in the art.

1 Thus, the present invention in its various aspects and embodiments comprises a
2 combination of features and characteristics that are directed to overcoming various
3 shortcomings of the prior art. The various features and characteristics described above, as
4 well as other features and characteristics, will be readily apparent to those skilled in the art
5 upon reading the following detailed description of the preferred embodiments and by
6 reference to the appended drawings.

7 Since the description and drawings that follow are directed to particular embodiments,
8 however, they shall not be understood as limiting the scope of the invention. They are
9 included to provide a better understanding of the invention and the way it may be practiced.
10 The subject invention encompasses other embodiments consistent with the claims set forth
11 herein.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1A is a schematic illustration of a liner assembly **10** being cemented in a bore **4** of a well **1**, which liner assembly **10** includes first preferred embodiments **20** of centralizing assemblies of the subject invention.

FIG. 1B is a schematic illustration showing liner assembly **10** after it has been cemented in bore **4**.

FIG. 2 is an isometric view of a centralizing assembly **20** shown schematically in **FIGS. 1**, which centralizing assembly **20** is assembled on a portion of liner **10** and includes a pair of first embodiments **30** of the stop collars of the subject invention.

FIG. 3 is an isometric view of stop collar **30**.

FIG. 4 is an exploded, isometric view of stop collar **30** showing a male sleeve **34**, a compressible band **33**, and a female sleeve **35** from which stop collar **30** is assembled.

FIG. 5 is an axial cross-sectional view of stop collar **30** in its set or installed state.

In the drawings and description that follows, like parts are identified by the same reference numerals. The drawing figures are not necessarily to scale. Certain features of the embodiments may be shown exaggerated in scale or in somewhat schematic form and some details of conventional design and construction may not be shown in the interest of clarity and conciseness.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

The subject invention relates generally to tool assemblies and stop collars that may be mounted on a liner or other tubular member in a fixed position and encompasses various embodiments and aspects. Some of those embodiments are described in some detail herein. For the sake of conciseness, however, all features of an actual implementation may not be described or illustrated. In developing any actual implementation, as in any engineering or design project, numerous implementation-specific decisions must be made to achieve a developers' specific goals. Decisions usually will be made consistent within system-related and business-related constraints, and specific goals may vary from one implementation to another. Development efforts might be complex and time consuming and may involve many aspects of design, fabrication, and manufacture. Nevertheless, it should be appreciated that such

1 development projects would be a routine effort for those of ordinary skill having the
2 benefit of this disclosure.

3 *Overview of Cementing Operations*

4 The novel centralizing assemblies may be used, for example, to help improve the
5 quality of a cement sheath that will be formed around a liner. Thus, a first preferred
6 centralizing assembly **20** incorporating a first preferred stop collar **30** will be described
7 by reference to **FIGS. 1**. **FIGS. 1** are schematic depictions of a liner assembly **10** being
8 cemented in an oil and gas well **1**. Liner assembly **10** incorporates a number of
9 centralizing assemblies **20**.

10 Referring first to **FIG. 1A**, well **1** is serviced by a derrick **2** and various surface
11 and downhole equipment for pumping cement and circulating fluids (not shown). The
12 upper portion of well **1** is provided with a casing **3**, while the lower portion is an open
13 bore **4** extending generally horizontally through a hydrocarbon bearing formation **5**.

14 Liner assembly **10** has been suspended from casing **3** by a liner hanger **11** and
15 extends through open bore **4**. Liner assembly **10** includes various tools, including a toe
16 valve **12** and a float assembly **13**. Float assembly **13** typically includes various tools that
17 assist in running liner **10** into well **1** and cementing it in bore **4**, such as a landing collar
18 **14**, a float collar **15**, and a float shoe **16**. Centralizing assemblies **20** are mounted around
19 liner **10** and serve to maintain clearance between liner **10** and bore **4**.

20 **FIG. 1A** depicts well **1** as liner **10** is being cemented in bore **4**. A quantity or
21 “pad” of cement **6** is being pumped into liner **10**, out its lower end, and into the annulus
22 between liner **10** and bore **4**. As cement **6** is pumped, it displaces drilling fluids **7** already
23 present in liner **10** and the annulus. Cement **6** and fluids **7** are able to flow through the
24 annulus and past centralizing assemblies **20**.

25 A wiper plug **17** is being pumped behind cement **6**. It follows the pad of cement **6**
26 as it flows through liner **10**. Wiper plug **13** will help clean and remove cement **6** from the
27 inside of liner **10**. It will pass through toe valve **12** and eventually seat on landing collar
28 **14** in float assembly **13**. Pumping will continue until cement **6** completely fills the
29 annulus between liner **10** and bore **4**.

30 **FIG. 1B** shows well **1** after completion of the cementing operation. Cement **6** has
31 been allowed to set. Centralizing assemblies **20** have enabled cement **6** to form a sheath

1 completely around liner **10**. Derrick **2** and the cementing equipment have been replaced
2 by well head **8** and other surface equipment (not shown). The equipment may be used,
3 for example, to perforate liner **10** and to penetrate cement sheath **6** in selected areas to
4 allow hydrocarbons to flow from formation **5** into liner **10**.

5 The terms “upper” and “lower” and “uphole” and “downhole” as used herein to
6 describe location or orientation are relative to the well and to the tool as run into and
7 installed in the well. Thus, “upper” and “uphole” refers to a location or orientation
8 toward the upper or surface end of the well. “Lower” or “downhole” is relative to the
9 lower end or bottom of the well. It also will be appreciated that the course of the
10 wellbore may not necessarily be as depicted schematically in **FIGS. 1**. Depending on the
11 location and orientation of the hydrocarbon bearing formation to be accessed, the course
12 of the wellbore may be more or less deviated in any number of directions. “Axial,”
13 “radial,” “angularly,” and forms thereof reference the central axis of the tools. For
14 example, axial movement or position refers to movement or position generally along or
15 parallel to the central axis. “Lateral” movement and the like also generally refers to up
16 and down movement or positions up and down the tool. “Radial” will refer to positions
17 or movement toward or away from the central axis.

18 *Overview of Preferred Centralizing assemblies*

19 As noted above, the novel centralizing assemblies may be used to ensure that
20 there is sufficient clearance between a liner and a wellbore so that a continuous sheath of
21 cement may be formed. Broad embodiments incorporate a centralizer and one or more
22 novel stop collars. For example, centralizing assembly **20** is shown in greater detail in
23 **FIG. 2**. As illustrated therein, centralizing assembly **20** comprises a centralizer **21** which
24 is mounted between a pair of first preferred embodiments **30** of the stop collars of the
25 subject invention.

26 Centralizer **21** is a spiral-blade type centralizer. It has a generally cylindrical
27 body **22** that may be mounted on a portion of liner **10**, for example, by sliding it over a
28 joint of liner **10** as it is made up and run into well **1**. The outer surface of body **22** is
29 provided with raised features to space liner **10** from bore **4**, such as four rounded, rather
30 blunt blades **23**. Blades **23** extend laterally between the two ends of body **22**, generally
31 along the line of a loose helix. The height of blades **23** is greatest in their mid-region and

1 tapers toward both ends of body **22**. Blades **23** serve to maintain clearance between liner
2 **10** and bore **4** while at the same time allowing cement **6** to flow laterally past and around
3 body **22**.

4 Centralizer **21** is not fixedly carried on liner **10**. It is free to rotate about liner **10**
5 and to move laterally along liner **10**. A first stop collar **30a** is mounted above centralizer
6 **21**, and a second stop collar **30b** is mounted below centralizer **21**. Stop collars **30** are
7 fixedly mounted to liner **10**. Lateral movement of centralizer **21** along liner **10**, therefore,
8 is limited by stop collars **30**. Allowing such freedom of movement helps minimize the
9 risk that centralizer **21** will hang up in casing **3** or wellbore **4** as liner **10** is run into well
10 **1**. It will be appreciated that for some applications only a single stop collar **30** may be
11 required to restrict lateral movement of centralizer **21**. For example, centralizer **21** may
12 be mounted on liner **10** between a single stop collar **30** and a threaded box or other
13 enlarged portion of a liner joint.

14 It will be appreciated that the novel centralizing assemblies may incorporate any
15 conventional centralizer requiring the use of stop collars. Such centralizers include not
16 only spiral blade centralizers, such as centralizer **21**, but also slip-on bow spring
17 centralizers. Many different centralizers are available from Top-Co, Weatherford, and
18 other manufacturers and suppliers.

19 ***Overview of First Preferred Stop Collar***

20 As noted above, the novel stop collars may be mounted on a liner or other tubular
21 member and used, for example, to limit the lateral movement of a tool such as a
22 centralizer. Broad embodiments of the novel stop collars comprise first and second
23 members which may be displaced laterally relative to each other. A radially expandable
24 gripping member is disposed between opposing thrust surfaces on the displaceable
25 members. The members may be drawn together to expand the gripping member radially
26 inward into frictional engagement with a liner.

27 Stop collar **30**, for example, is incorporated into centralizing assembly **20** to limit
28 the lateral movement of centralizer **21**. Stop collar **30** is shown in greater detail in **FIGS.**
29 **3-5**. As shown therein, stop collar **30** generally comprises a male sleeve **34**, a
30 compressible band **33**, and a female sleeve **35**. Compressible band **33** is carried within
31 stop collar **30** between male sleeve **34** and female sleeve **35**. Stop collar **30** may be slid

1 over liner **10** (not shown in **FIGS. 3-5**). Male sleeve **34** and female sleeve **35** may be
2 threaded together to compress band **33** and expand it radially inward into frictional
3 engagement with liner **10**.

4 More specifically, male sleeve **34** has a generally cylindrical body **41**. The inner
5 diameter of body **41** is substantially uniform and is slightly larger than the outer diameter of
6 liner **10**. Male sleeve **34** will fit closely, but still loose enough that it can slide easily along
7 liner **10**. The outer end **42** of male body **41** has a radial thickness and provides an annular
8 surface normal to the circumference of liner **10**. As will be appreciated from **FIG. 2**, stop
9 collar **30** preferably will be mounted on liner **10** such that outer end **42** of male body **41**
10 provides a stop surface limiting travel of centralizer **21** along liner **10**. The inner end of body
11 **41** has a reduced outer diameter and terminates in an annular thrust surface **43** extending
12 radially and normal to the outer circumference of liner **10**. A substantial portion of the
13 reduced diameter portion of the inner end of body **41** is provided with external threads **44**.

14 Female sleeve **35** also has a generally cylindrical body **51**. The inner diameter of body
15 **51** is sized to allow female sleeve **35**, like male sleeve **34**, to slide easily along liner **10**. The
16 outer end **52** of female body **51** preferably is chamfered to provide stop collar **30** with a
17 tapered leading edge to reduce the risk of centralizing assembly **20** hanging up as liner **10** is
18 run into or out of well **1**. The inner end of body **51** has an area of increased inner diameter
19 forming an internal, inward-facing annular shoulder or thrust surface **53**. The inner end of
20 body **51** is provided with internal threads **54**.

21 Compressible band **33** is an annular body which, in its uncompressed, as-assembled
22 state, is sized to fit loosely around liner **10**. Band **33** is carried radially within the enlarged
23 inner diameter portion of body **51** of female sleeve **35**. It is disposed axially between thrust
24 surface **43** in male sleeve **34** and thrust surface **53** in female sleeve **35**. Male sleeve **34** is
25 assembled to female sleeve **35** by the engagement of their respective threads **44** and **54**. Thus,
26 when male sleeve **34** and female sleeve **35** are relatively loosely engaged and compressible
27 band **33** is relatively uncompressed, stop collar **30** may be slid over liner **10** for installation.

28 Once it is slid around liner **10**, stop collar **30** may be fixedly mounted to liner **10** by
29 rotating the threaded connection to draw male sleeve **34** and female sleeve **35**

1 together. As male sleeve **34** and female sleeve **35** are drawn together, they will begin to
2 compress compressible band **33**. Band **33** is radially supported along its width by the
3 enlarged diameter portion of female sleeve **35**. Thus, as compressible band **33** is
4 compressed between thrust surfaces **43** and **53**, it will tend to expand radially inward and
5 into engagement with liner **10**, gripping it and fixedly securing stop collar **30** on liner **10**.

6 The gripping member preferably will establish non-corrosive contact between the
7 stop collar and liner. The contact may be non-corrosive in the sense that it is non-
8 penetrating. That is, the gripping member does not significantly abrade or score the liner.
9 It may be non-corrosive in the sense that it does not create electrolytic contact between
10 the stop collar and liner. That is, the gripping member will not create significant
11 electrolysis between the stop collar and liner. Preferably, the contact will be both non-
12 penetrating and non-electrolytic.

13 Compressible band **33**, for example, may be made from any material capable of
14 radially expanding into a state of elastic compression. Preferably, however, band **33** is
15 fabricated from elastomers, such as nitrile butadiene rubber (NBR), hydrogenated nitrile
16 butadiene nitrile rubber (HNBR), and fluoroelastomers such as Viton®, or
17 polytetrafluoroethylene. Such materials may allow stop collar **30** to be securely mounted
18 without damaging the surface of liner **10** and potentially shortening its service life.

19 That is, it will be appreciated that conventional collars may employ set screws, or
20 they may have metal teeth or other gripping features that bite into liner **10**. Liner **10**
21 typically will be made of very hard, durable steel, but nevertheless, it will be exposed to
22 harsh fluids, potentially from within and without, and potentially over a long service life.
23 Abrasion and scoring of the metal may make liner **10** more susceptible to corrosion and,
24 if there is contact between dissimilar metals, to electrolytic corrosion. When
25 compressible band **33** is fabricated from elastomers, such issues may be avoided. Other
26 materials, however, may be used to establish non-penetrating or non-electrolytic contact
27 between the stop collar and liner.

28 In some applications, it may be acceptable to use soft, ductile metals such as brass
29 and aluminum alloys to fabricate gripping members. Such materials generally are not
30 preferred. While they typically will be non-penetrating and may not significantly score
31 or otherwise damage a liner during installation, they still create issues of electrolytic

1 corrosion. Thus, as a general matter, gripping members, like an elastomer band, which
2 establish non-electrolytic contact between the liner and the stop collar as well as non-
3 penetrating contact are preferred.

4 An elastomeric band **33** also may provide stop collar **30** with a “self-energizing”
5 grip on liner **10**. That is, as centralizer **21** bears on bottom end **42** of male sleeve **34** it
6 will tend to urge stop collar **30** to travel along liner **10**. Male sleeve **34** and female sleeve
7 **35** fit loosely around liner **10**. They may be displaced fairly easily, especially if
8 significant torque is not created through stop collar **30**. Elastomeric band **33**, however, is
9 frictionally engaged with liner **10** and will resist displacement. Thrust surface **54** on
10 female sleeve **35**, therefore, may pull away from band **33**. Thrust surface **44**, however,
11 will bear on band **33**, compressing it, further expanding it radially inward, and increasing
12 its coefficient of friction. The load on stop collar **30**, of course, may become so high that
13 it will force elastomer band **33** to skip or extrude. Until it reaches that point, however,
14 the grip on liner **10** will increase with load. Such dynamics also can provide a shock
15 absorbing effect, and help minimize the risk of damage to centralizer **21** and stop collar
16 **30** as liner **10** travels through the well.

17 A band, such as band **33**, also may be preferred as it provides a relatively large
18 area of contact around liner **10** and correspondingly more frictional resistance to
19 movement. Band **33** also may be provided with various features, such as raised nubs,
20 ridges, or other embossments to facilitate a frictional engagement between band **33** and
21 liner **10**. The gripping member, however, may have various other configurations. For
22 example, a plurality of discrete gripping members also may be provided and arrayed
23 angularly about the inner circumference of the stop collars.

24 Similarly, the threaded connection between male sleeve **34** and female sleeve **35**
25 provide a simple, effective mechanism for drawing their thrust surfaces **43** and **53**
26 together to compress and radially expand band **33** radially inward. Other mechanisms,
27 however, may be used. For example, the stop collars may incorporate a pair of terminal
28 or end sleeves, each having a threaded end. The threads on the end sleeves may spiral in
29 opposite directions – the threads on one sleeve being right-handed, and the threads on the
30 other being left-handed. A central or connection sleeve may be provided with opposing
31 internal threads on each end. The connection sleeve may be used to connect and draw the

1 two end sleeves together. Other conventional means of drawing opposing thrust surfaces
2 together may be used.

3 It also will be appreciated that the novel collars may be provided with other
4 features that may make installation easier or enhance their reliability. For example, holes
5 **45** and **55** may be provided, respectively, on male sleeve **34** and female sleeve **35**. Pins
6 on a spanner tool may be inserted into holes **45** and **55** to rotate sleeves **34** and **35** during
7 installation or to remove them from liner **10**. The novel stop collars also preferably will
8 have a mechanism to ensure that once they are installed on liner **10**, the threaded
9 connection between male sleeve **34** and female sleeve **35** will not loosen to the point
10 where stop collar **30** will slide along liner **10**.

11 For example, as best seen in **FIGS. 3-4**, female sleeve **35** is provided with a series
12 of notches or detents **56** arrayed angularly around its inner end. Male sleeve **34** is
13 provided with one or more pivoting pawls **46** mounted in its mid-region. Pawl **46** is
14 spring-load to bias it into detents **56**. Detents **56** are shaped such that, when male sleeve
15 **34** and female sleeve **35** are rotated to draw them together, pawl **46** will pivot into and
16 then ramp out of detents **56**. Instead of a ramp, the other face of detents **56** is designed to
17 fit and catch pawl **46**. Thus, once male sleeve **34** and female sleeve **35** have been drawn
18 together fully to mount stop collar **30** on liner **10**, pawl **46** will catch in a detent **56** and
19 prevent significant separation of male sleeve **34** and female sleeve **35** or relaxation of
20 band **33**.

21 It will be appreciated, of course, that suitable pawl-detent mechanisms may have
22 other designs and effectively prevent loosening of stop collar **30**. Likewise, other
23 mechanisms for preventing relative rotation between male sleeve **34** and female sleeve **35**
24 once they have been drawn together may be used. For example, a set screw may be
25 threaded through female sleeve **35** and driven into frictional engagement with male
26 sleeve **34**. Other designs are known in the art and may be used.

27 In general, the novel stop collars may be fabricated from materials typically used
28 in stop collars of this type. Given the extreme stress and the corrosive and abrasive fluids
29 to which they may be exposed, suitable materials will be hard and strong. For example,
30 excepting their gripping member as discussed above, the components of novel stop
31 collars may be fabricated from 4130 and 4140 chromoly steel or from somewhat harder,

1 stronger steel such as 4130M7, high end nickel alloys, and stainless steel. The
2 components may be made by any number of conventional techniques, but typically and in
3 large part will be made by forging, extruding, or mold casting a blank part and then
4 machining the required features into the part.

5 The novel stop collars have been described as being mounted on a liner and, more
6 specifically, a production liner. A “liner,” however, can have a fairly specific meaning
7 within the industry, as do “casing” and “tubing.” In its narrow sense, a “casing” is
8 generally considered to be a relatively large tubular conduit, usually greater than 4.5” in
9 diameter, that extends into a well from the surface. A “liner” is generally considered to
10 be a relatively large tubular conduit that does not extend from the surface of the well, and
11 instead is supported within an existing casing or another liner. In essence, it is a “casing”
12 that does not extend from the surface. “Tubing” refers to a smaller tubular conduit,
13 usually less than 4.5” in diameter. The novel stop collars, however, are not limited in
14 their application to liners as that term may be understood in its narrow sense. They may
15 be used to advantage in liners, casings, tubing, and other tubular conduits or “tubulars” as
16 are commonly employed in oil and gas wells.

17 The novel stop collars also have been described in the context of centralizing
18 assemblies used in cementing operations. They may be used in centralizing assemblies
19 for other applications, such as “casing-while-drilling” operations where a bit is attached
20 at the end of a liner to drill a bore and install a liner at the same time. They may be used
21 to limit the travel of centralizers, but they also may be incorporated into centralizers
22 which are fixedly mounted on a liner. For example, a pair of novel stop collars may be
23 joined by bow springs to provide a centralizer that may be mounted securely in a
24 particular location along a liner. A more elongated sleeve may be provided with spiral
25 blades, and each end configured generally as is the inner end of female sleeve **35**. A
26 male sleeve **34** then may be assembled to each end of the spiral-blade sleeve to mount it
27 in a fixed location on a liner.

28 Moreover, while they are particularly useful in centralizing assemblies, the novel
29 stop collars have other applications. They may be used in or with other tools, such as
30 cement baskets and scrapers. They also may be used as guides or protectors for sucker

1 rods and tubing. In general, they may be adapted and employed for many different
2 applications calling for a fixedly mounted collar around a tubular member.

3 While this invention has been disclosed and discussed primarily in terms of
4 specific embodiments thereof, it is not intended to be limited thereto. Other
5 modifications and embodiments will be apparent to the worker in the art.

6

1 CLAIMS:

- 2 1. A collar for mounting on a tubular member, said mountable collar comprising:
- 3 (a) a first sleeve and a second sleeve, said sleeves:
- 4 i) being adapted to extend around the outer circumference of said tubular member;
- 5 ii) being engaged by threaded connections; and
- 6 iii) providing opposing inner thrust surfaces;
- 7 (b) a radially expandable gripping member disposed between said opposing thrust
- 8 surfaces;
- 9 (c) wherein said sleeves are capable of being drawn together by rotation about said
- 10 threaded connection to cause said thrust surfaces to bear on said gripping member and
- 11 expand said gripping member radially inward into frictional engagement with said
- 12 tubular member.
- 13 2. The collar of claim 1, wherein said gripping member engages said tubular member
- 14 without penetrating said member.
- 15 3. The collar of claim 1 or 2, wherein said gripping member engages said tubular member
- 16 without creating electrolytic contact between said collar and said tubular member.
- 17 4. The collar of any one of claims 1 to 3, wherein said first sleeve is provided with external
- 18 threads engaging internal threads on said second sleeve and said gripping member is
- 19 disposed between the inner end of said first sleeve and an annular shoulder in said second
- 20 sleeve.
- 21 5. The collar of any one of claims 1 to 4, wherein said second sleeve provides radial support
- 22 for said gripping member.
- 23 6. The collar of any one of claims 1 to 5, wherein said gripping member is carried in an
- 24 expanded inner diameter portion of said second sleeve.
- 25 7. The collar of any one of claims 1 to 6, wherein said gripping member is a compressible
- 26 band.
- 27 8. The collar of any one of claims 1 to 7, wherein said compressible band is fabricated from
- 28 an elastomer.

- 1 9. The collar of any one of claims 1 to 8, wherein said collar comprises means for restricting
2 loosening of said threaded engagement between said sleeves.
- 3 10. The collar of claim 9, wherein said first sleeve comprises a pawl and said second sleeve
4 comprises detents angularly spaced along the inner end of said second sleeve, said pawl
5 selectively engaging said detents to restrict loosening of said threaded engagement
6 between said sleeves.
- 7 11. The collar of claim 9, wherein a set screw is provided to restrict loosening of said threaded
8 engagement between said sleeves.
- 9 12. A collar for mounting on a tubular member, said mountable collar comprising:
10 (a) a first member and a second member, said members being:
11 i) adapted for lateral displacement relative to each other; and
12 ii) providing opposing inner thrust surfaces; and
13 (b) a radially expandable gripping member disposed between said opposing thrust
14 surfaces;
15 (c) wherein said members are capable of being drawn laterally together to cause said
16 thrust surfaces to bear on said gripping member and expand said gripping member
17 radially inward into frictional engagement with said tubular member,
18 (d) wherein said gripping member engages said tubular member without penetrating said
19 tubular member.
- 20 13. The collar of claim 11 or 12, wherein said gripping member engages said tubular member
21 without creating electrolytic contact between said collar and said tubular member.
- 22 14. The collar of any one of claims 11, 12, and 13, wherein one of said first or second
23 members provides radial support for said gripping member.
- 24 15. The collar of any one of claims 11-12 and 13-14, wherein said gripping member is a
25 compressible band.
- 26 16. The collar of any one of claims 11-12 and 13-15, wherein said compressible band is
27 fabricated from an elastomer.
- 28 17. A tool for mounting on a tubular; said tool comprising a collar of any one of
29 claims 1-12 and 13-16.

- 1 18. The tool of claim 17, wherein said tool is a stop collar.
- 2 19. A centralizing assembly for a tubular member, said assembly comprising:
 - 3 (a) a centralizer tool comprising spacing members, said spacing members extending
 - 4 radially outward beyond said tubular member and defining lateral channels; and
 - 5 (b) a stop collar of claim 18.
- 6 20. A tubular assembly, said tubular assembly comprising a tubular and a centralizer assembly
- 7 of claim 19.

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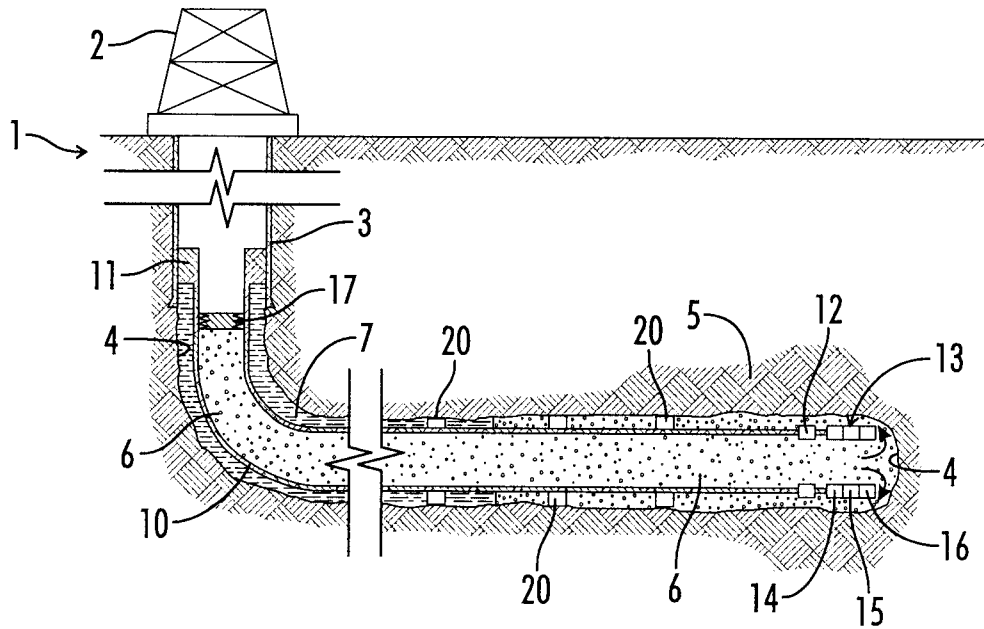


FIG. 1A

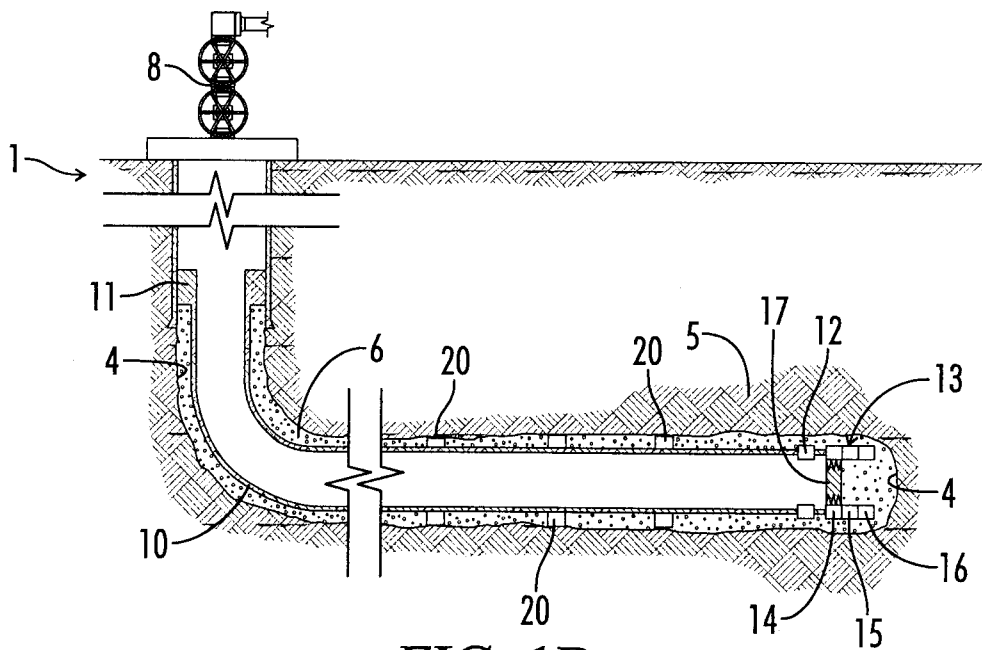


FIG. 1B

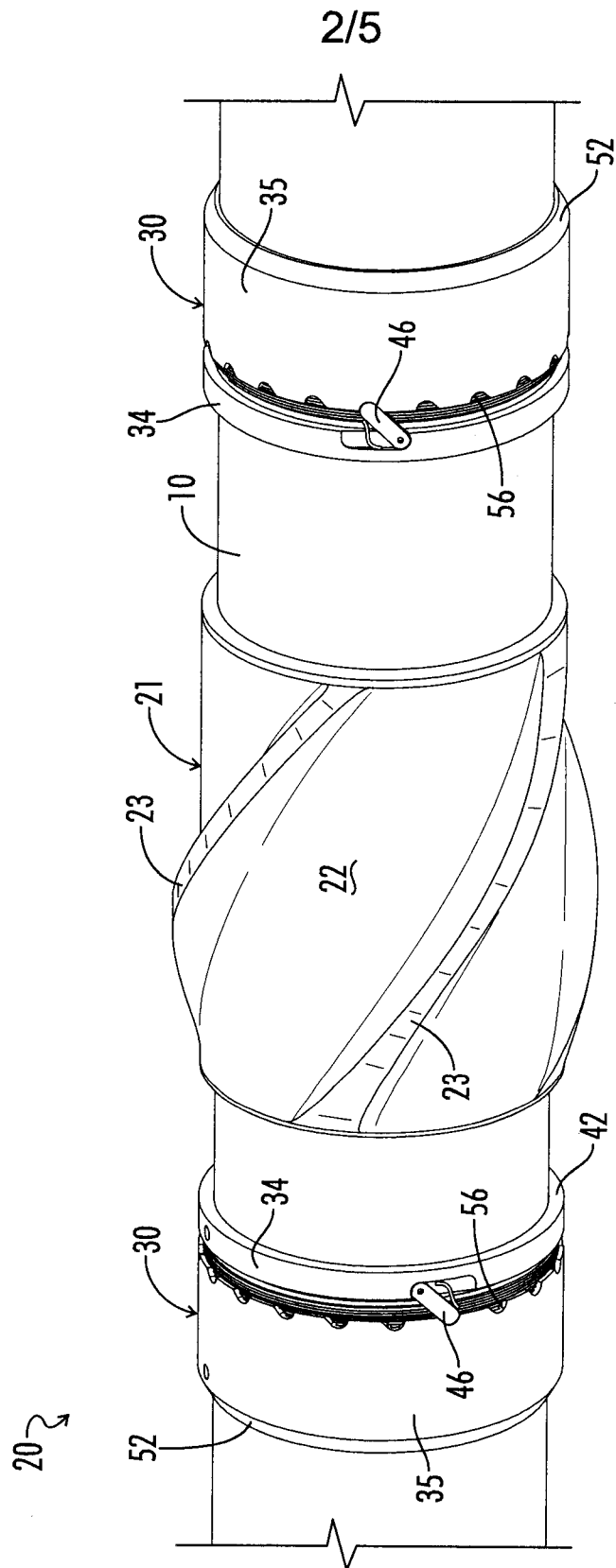


FIG. 2

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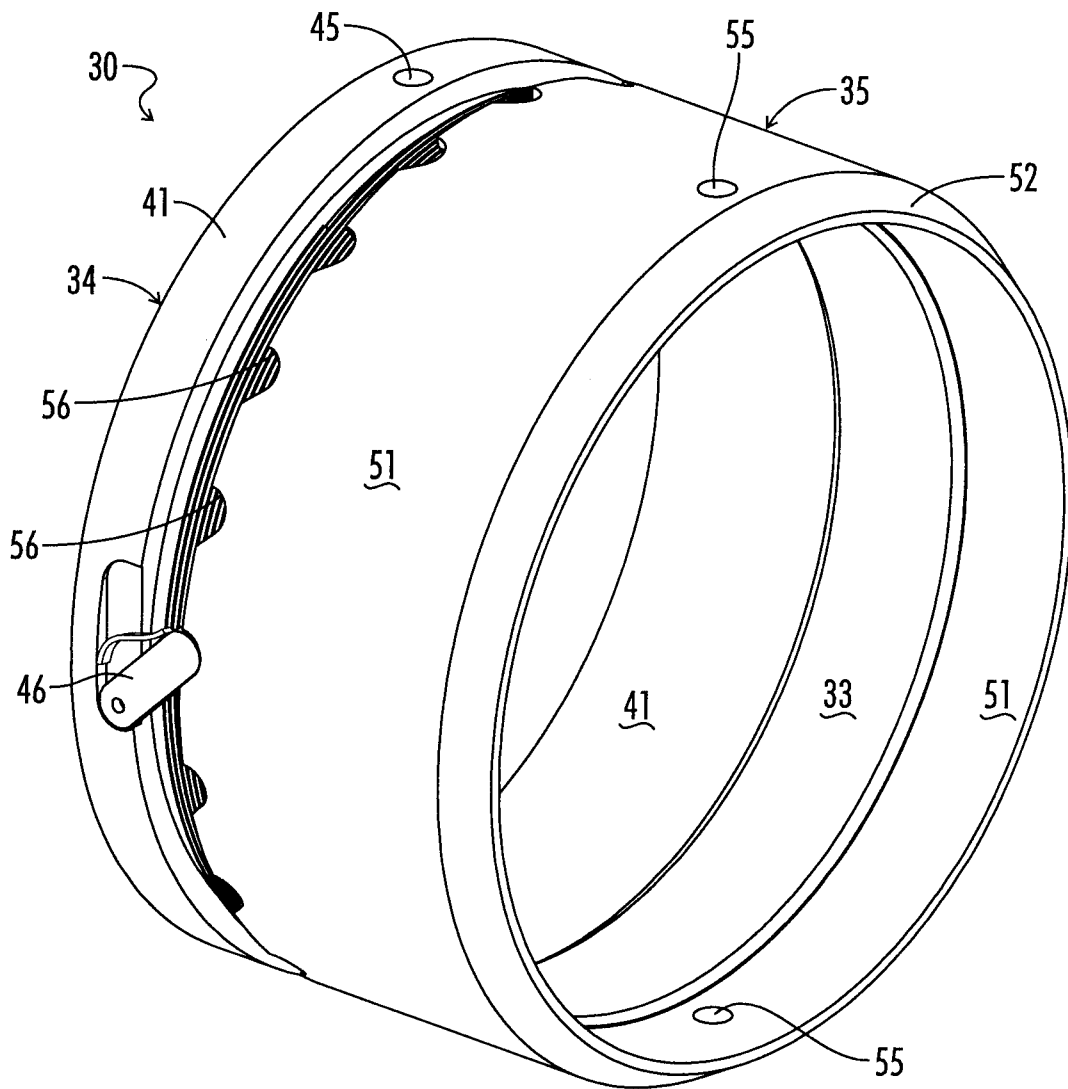
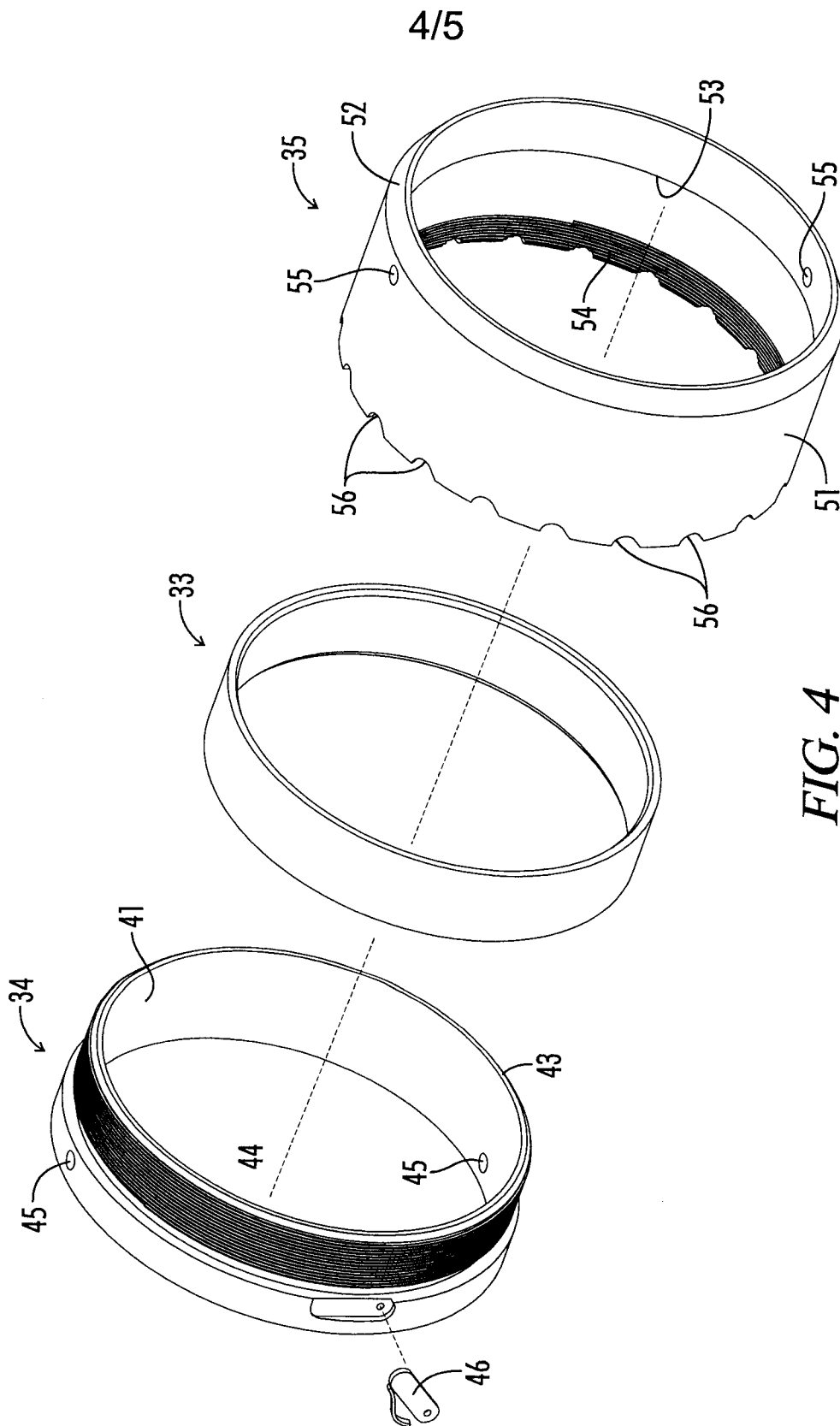


FIG. 3



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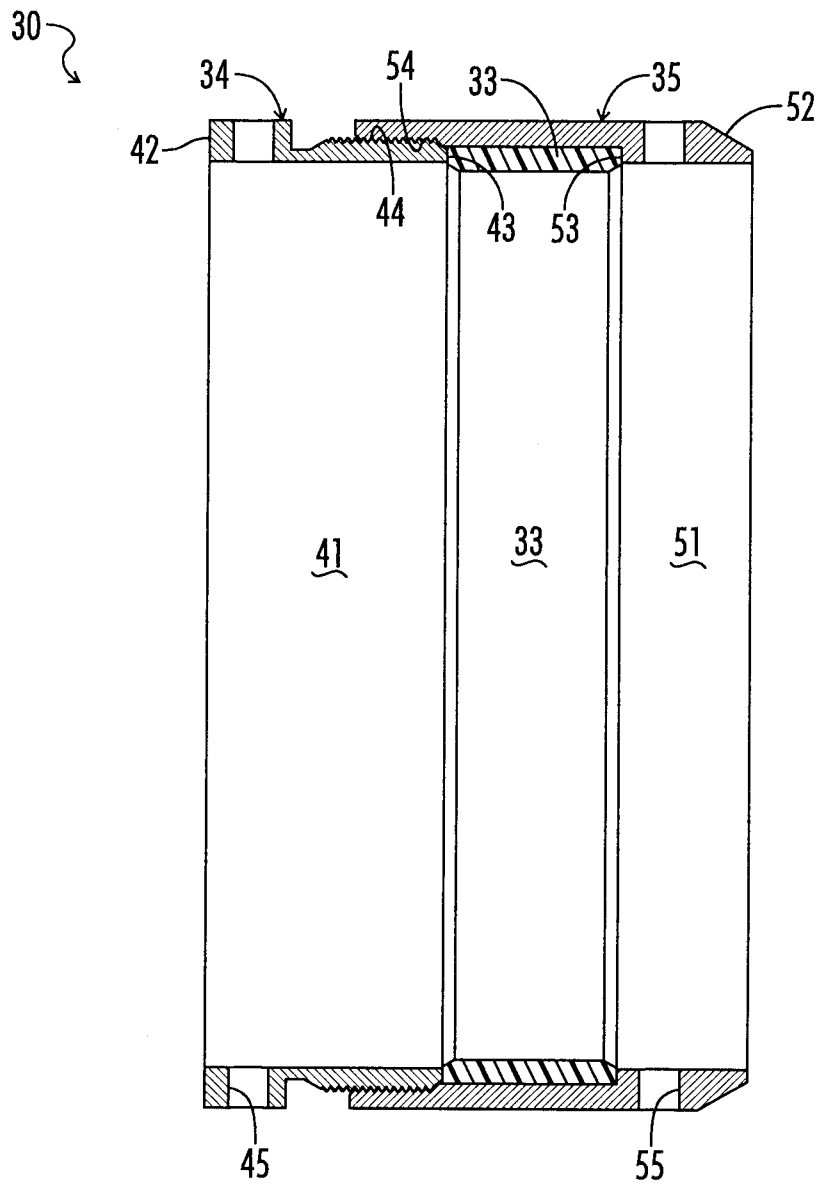


FIG. 5

