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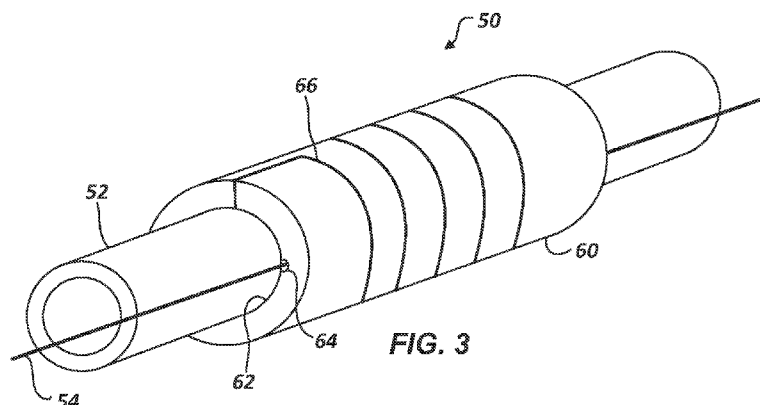
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(54) Title: COMPRESSIBLE PACKING ELEMENT FOR CONTINUOUS FEED-THROUGH LINE



(57) Abstract: A downhole tool accommodates a feed-through line running along a tubing string. The tool has a mandrel and a sleeve disposed on the mandrel. The feed-through line runs adjacent the mandrel and can be accommodated in a groove defined in an inner dimension of the sleeve. When deployed and compressed, the sleeve is compressible from an uncompressed state to a compressed state in which the sleeve expands radially outward to seal in casing or borehole. The sleeve defines a radial spiral slit along a length of the sleeve and wraps around the mandrel and the feed-through line. External spacing of the radial slit on an exterior of the sleeve can vary along the length of the sleeve, and a cross-sectional angle of the radial slit from an interior to an exterior of the sleeve can vary along the length of the sleeve.



Compressible Packing Element for Continuous Feed-Through Line**CROSS-REFERENCE TO RELATED APPLICATIONS**

[0001] This application claims the benefit of U.S. Prov. Appl. 62/022,346, filed 09-JUL-2014, which is incorporated herein by reference in its entirety.

BACKGROUND OF THE DISCLOSURE

[0002] A packing element is used on a downhole tool of a tubing string to create zonal isolation, for example, between production zones during hydraulic fracturing and during the production of an oil or gas well. In some implementations, various types of lines may be run along the tubing string and may need to pass the isolation provided by the packing element. Typically, the line can be a fiber optic cable used to convey data, or the line can be a hydraulic control line or the like.

[0003] One way to pass the line past the packing element involves positioning the line between the tool's mandrel and the internal dimension of the packing element. In this arrangement, the sealing abilities of the packing element are not particularly affected, and the packing element can help protect the line during run in. However, for some types of lines, such as continuous feed-through lines, integrating the line in this arrangement requires the packing element and the line to be assembled on the rig before deployment, which can be tedious and can delay operations. In addition, being able to use a continuous feed-through line that does not have any connectors and the like can be complicated. Overall, integrating a line on the packing element requires special considerations that typically equate to rig time, cost, and a restriction in the type of feed-through mechanism employed.

[0004] Traditionally, swellable packing elements have been used in feed-through for continuous lines as discussed above. Figs. 1 and 2A-2D show an example of a feed-through arrangement for a swellable packing

element 20 disposed on a mandrel 12 of a downhole tool 10, such as a swellable packer. In particular, Fig. 1 illustrates the mandrel 12 having the swellable packing element 20 of the prior art with an internal feed-through arrangement. Figs. 2A-2D respectively illustrate an end view, a partial cross-sectional view, a full cross-sectional view, and a side view of the mandrel 12 and the swellable packing element 20 of Fig. 1.

[0005] For the feed-through, one or more internal channels 24 can be defined along the inside dimension 22 of the swellable packing element 20 to accommodate passage of one or more lines 14. As noted above, this arrangement may not be suited where a continuous line 14 is to be run along a tubing string because the swellable packing element 20 on the mandrel 12 must typically be preassembled with a section of line 14 already integrated into the channel 24. This requires connectors and the like to couple additional line on the tubing string with the section of line 14 on the mandrel 12, which may be undesirable in some implementations.

[0006] Therefore, to allow one or more continuous lines 14 to be run along the mandrel 12, the swellable packing element 20 of Figs. 1 and 2A-2D has a cut 26 along the length of the swellable packing element 20. This arrangement allows the swellable packing element 20 to be removed from the mandrel 12 at the rig so the continuous line 14 running along the tubing string can be positioned along the mandrel 12. Then, the swellable packing element 20 can be reassembled onto the mandrel 12 over the sections of the continuous lines 14 so the tool 10 can be deployed. Because the packing element 20 is composed of a swellable material, the swelling closes any fluid paths that may be caused by the cut 26.

[0007] In another arrangement for a feed-through line on a swellable packing element, an external groove may be defined on the outer dimension of the swellable packing element. Because the element swells, it will engulf the line. Some examples of this type of external feed-through of a swellable packing element are disclosed in U.S. Pat. Pub. 2009/0277652.

[0008] Although suitable for their purposes, swellable packing elements can require considerable time (e.g., several days or weeks) to swell. Additionally, the pressure the swellable packing elements generate to seal against the wellbore can be comparatively low, which limits how much pressure they can hold. For these reasons, swellable packing elements are not suited for certain implementations, such as hydraulic fracturing.

[0009] Historically, feed-through has not been provided for compressible packing elements that are set hydraulically or mechanically. For one reason, the way that the feed-through line must pass through or adjacent to the compressible packing element can dramatically affect the time required to install the tool at the rig and can alter the function of the tool once deployed.

[0010] Packers having compressible packing elements have been developed that have lines integrated into the mandrel below the compressible packing element. These packers perform well in testing and are fully assembled at the manufacturing facility, reducing the time to install at the rig. However, these packers require a discontinuous section of line to be used on the tool. Any lines used for well monitoring or other type of system must also be discontinuous, which may be problematic or undesirable for some implementations.

[0011] The subject matter of the present disclosure is directed to overcoming, or at least reducing the effects of, one or more of the problems set forth above.

SUMMARY OF THE DISCLOSURE

[0012] As noted above, providing a feed-through (especially for a continuous line) past a compressible packing element on a tool can be problematic. In one solution, a channel can run longitudinally along an internal dimension of a compressible packing element to accommodate passage of a line along a tool's mandrel. Unfortunately, this solution may require a section of the line to be preinstalled in this channel on the tool.

As already noted, use of a discontinuous section of line may not be desirable where use of continuous line is needed.

[0013] In a second reverse arrangement, the outside dimension of the compressible packing element can define a channel to accommodate a line running along the packing element. Because the groove channel is external, installing the line at the rig is often quicker. Still, the external channel in the compressible packing element can cause the element to lose its structural integrity when the element is compressed. Moreover, the line may become damaged during compression of the element, or the presence of the external line and the channel can prevent adequate sealing.

[0014] In third solution, a cut can be provided along a length of a compressible packing element so it can be removed during assembly and deployment at the rig. With the compressible element removed from the tool's mandrel, a continuous line can be run along the mandrel. Then, the compressible packing element can be reinstalled on the mandrel over the continuous line.

[0015] Although this arrangement solves some of the problems found with the other solution, this arrangement can still be problematic. The cut that allows the compressible packing element to be removed and reinstalled runs along the element. Therefore, the packing element can lose its ability to be compressed uniformly due to the presence of this cut. Additionally, the cut may present a leak path where fluid can bypass the desired isolation from the compressed packing element. For example, as the packing element sets longitudinally, it expands radially causing the cut to part and present a wider gap through which pressure and fluid can flow.

[0016] To overcome at least some of the problems associated with the above solutions, a preferred solution according to the present disclosure uses a compressible packing element having a slit formed around a circumference and along a length of a compressible packing element having the form of a sleeve. In one particular embodiment, for example, a downhole tool for accommodating a feed-through line has a mandrel and a

sleeve. The mandrel accommodates adjacent passage of the feed-through line, such as a continuous line. The tool is used for packing off the annulus of a borehole or the like, and the feed-through line can be a hydraulic, electric, fiber optic, or other type of line for running downhole to operate various tools or functions. The tool can include at least one gage ring disposed on the mandrel that is movable thereon to compress against at least one end of the sleeve.

[0017] The sleeve, which can be composed of an elastomer, is disposed on the mandrel and defines a slit formed around a circumference and along a length of the sleeve. The slit sleeve wraps along the slit around the mandrel and the feed-through line. Once deployed, the sleeve is compressible from an uncompressed state to a compressed state so that the sleeve in the compressed state can pack against a surrounding surface, such as a tubular, casing, wellbore, etc.

[0018] The slit formed radially along the sleeve's length can have a number of modifications to enhance or at least assist with the compressibility and the packing ability of the packing element. For example, external spacing of the slit on an exterior of the sleeve can vary along the length of the sleeve. In particular, the slit's external spacing can vary from a wider spacing toward a first end of the sleeve to a narrower spacing toward a center of the sleeve. The external spacing may also vary from a second, opposite end of the sleeve toward the center in a manner complimentary to the first end toward the center. Internal spacing of the slit on an interior of the sleeve can also vary along the length of the sleeve.

[0019] In fact, a cross-sectional angle of the slit from an interior to an exterior of the sleeve can vary along the length of the sleeve. For instance, the cross-sectional angle can vary from a less acute angle toward a first end of the sleeve to a more acute angle toward a center of the sleeve. The angle for the slit at the opposite end of the sleeve toward the center can vary in a complimentary manner.

[0020] In general, the sleeve can have one or more components disposed end-to-end on the mandrel. For example, the sleeve can have at least two components disposed end-to-end on the mandrel, and the tool can include a centrally disposed ring on the mandrel between the ends of the at least two components.

[0021] For assembly of the downhole tool, the sleeve of compressible material can be formed. For example, conventional techniques of molding, extruding, shaping, cutting, and the like can be performed to produce the sleeve with a generally cylindrical shape typically used on downhole tools, such as packers. A slit is then formed around and along the sleeve. For example, the slit can be cut into the material of the formed sleeve using a blade or other cutting instrument. At least some or all of the slit can be formed in the forming (*e.g.*, molding) process of the sleeve. Either way, the spirally slit sleeve of compressible material is wrapped around a mandrel of the downhole tool to produce the compressible packing element on the mandrel. At least one channel may be formed on an interior dimension of the sleeve to accommodate a feed-through line running adjacent the mandrel. The method can also involve securing the sleeve (at least temporarily) wrapped on the mandrel using end rings, fixtures, sheathing, external wrapping, adhesive, etc.

[0022] To accommodate a feed-through line on a downhole tool during assembly steps, such as performed at a rig, the spirally slit sleeve of the compressible material can be unwrapped from the mandrel of the downhole tool. At this point, the feed-through line, which can be a continuous type of line used for well monitoring or other purposes, can be disposed adjacent the mandrel. Then, the spirally slit sleeve can be rewrapped in the form of the sleeve around the mandrel and the feed-through line. The rewrapped sleeve can then be secured.

[0023] The foregoing summary is not intended to summarize each potential embodiment or every aspect of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] Fig. 1 illustrates a mandrel having a swellable packing element with a continuous feed-through arrangement of the prior art.

[0025] Figs. 2A-2D respectively illustrate an end view, a partial cross-sectional view, a full cross-sectional view, and a side view of the mandrel and the swellable packing element of Fig. 1.

[0026] Fig. 3 illustrates a mandrel having a compressible packing element with a continuous feed-through arrangement according to the present disclosure.

[0027] Figs. 4A-4D respectively illustrate an end view, a partial cross-sectional view, a full cross-sectional view, and a side view of the mandrel and the compressible packing element of Fig. 3.

[0028] Figs. 5A-5B shows the compressible packing element being compressed between gage rings on the mandrel.

[0029] Figs. 6A-6B shows another compressible packing element being compressed between gage rings on the mandrel.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0030] Figs. 3 and 4A-4D show a continuous feed-through arrangement according to the present disclosure for a compressible packing element 60 on a mandrel 52 of a downhole tool 50. Fig. 3 illustrates the mandrel 52 having the compressible packing element 60 with the continuous feed-through arrangement according to the present disclosure for a continuous line 54. Figs. 4A-4D respectively illustrate an end view, a partial cross-sectional view, a full cross-sectional view, and a side view of the mandrel 52 and the compressible packing element 60 of Fig. 3.

[0031] The tool 50 can be a mechanically or hydraulically-set packer, plug, liner hanger, or other type of tool for packing an annulus. The mandrel 52 can be a solid housing or can be a housing with a bore as shown. Ends of the mandrel 52 may couple to other tubing components of a tubing string using conventional feature.

[0032] Moreover, various features (e.g., gage rings 70a-b, actuators, pistons, hydraulic chambers, etc.) for mechanically or hydraulically setting the tool 50 are known in the art and are not necessarily shown here in detail for the sake of simplicity. In general, the actuator (not shown) for compressing the packing element 60 can be part of or adjacent to one of the gage rings (e.g., 70a). Such an actuator can be operated to push the gage ring 70a along the mandrel 52 and compress the packing element 60 against the opposing gage ring 70b. To do this, the actuator can be a hydraulic, mechanical, electrical or other form of device known and used in the art.

[0033] The hydraulically or mechanically-set tool 50 with its radially applied packing element 60 is intended for use in well completions where one or more continuous, non-spliced lines 54 are used in well data monitoring or other operations. For example, the line 54 can be a data acquisition line, such as fiber-optic cable, used to convey data. However, the line 54 can be any continuous line, cable, conduit, capillary, or the like where its function would be hindered by discontinuity or where a discontinuous line would adversely affect the cost of the completion. As such, the continuous line 54 may be used for well monitoring.

Alternatively, the continuous line 54 may actually be a hydraulic control line employed to actuate various downhole tools, such as a piston set packer or sliding sleeve. These and other variations are possible.

[0034] As shown in Figs. 3 and 4A, one or more channels 64 can run longitudinally along the internal dimension 62 of the compressible packing element 60 and can be used to accommodate passage of one or more continuous lines 54 along the tool's mandrel 52. As particularly shown in the figures, the outside dimension of the compressible packing element 60 defines a slit 66 to accommodate assembly of the element 60, removal of the element 60, and then reassembly over the continuous lines 54 running along the mandrel 52. Because the compressible packing element 60 is removable, installing the continuous line 54 at the rig by removing the packing element 60 can be quicker than other operations.

[0035] Because the slit 66 in the compressible packing element 60 can cause the element 60 to lose its structural integrity when the element 60 is compressed, the slit 66 is defined with a configuration to mitigate these issues. In general, the slit 66 is a spiral in shape being defined around the circumference and along the length of the element 60. In one advantage, this spiral slit 66 creates a more torturous path for fluid and pressure, making it harder for a leak to develop across one end of the element 60 to the other and especially when the element is compressed. In another advantage, the configuration of the slit 66 can enhance the packing ability of the element 60.

[0036] The slit 66 can be formed with a number of variations discussed below. For example, the slit 66 can vary in external spacing along the length of the element 60, can vary in internal spacing along the length of the element 60, can vary in angle from exterior to interior, can vary from one end of the element 60 to the other, etc. These and other variations are discussed below.

[0037] Creating the element 60 with the slit 66 can be performed in a number of ways. For example, creating the element 60 with the slit 66 can involve forming (e.g., molding) the element 60 as a tubular element or sleeve with the slit 66 pre-formed therein. Alternatively, creating the element 60 can involve first forming a tubular element or sleeve of the compressible packing material (e.g., elastomer) and then cutting or machining the sleeve to include the slit 66. For example, the compressible packing element 60 can be composed of a long tubular element or sleeve of suitable elastomer or other material. Formation of the sleeve can involve various processes of molding, extruding, shaping, cutting, etc. The element 60 is sized to the desired inner dimension 62, outer dimension, and length for the particular tool 50 and desired application. The tubular element 60 is then cut in a spiral fashion around the circumference and along the length of the element 60 from one end 67a to the other end 67b.

[0038] A blade or other cutting element can form the slit 66 in the element 60. As the blade cuts the spiral pattern of the slit 66 in the tubular

element 60, the blade's insertion angle can be changed. Changing the angle creates a cross-sectional profile in which back angles of each spiral segment 69 may aid the adjoining segment 69 in ramping up on one another to create a uniform radial seal when the element 60 is compressed. Overall, as the blade cuts the spiral pattern of the slit 66 in the tubular element 60, the blade's spacing between turns, insertion angle, direction, and other parameters can be changed to alter the resulting shape of the slit 66.

[0039] As best shown in the side view of Fig. 4D, for example, the slit 66 defined in the compressible packing element 60 is formed with the spiral pattern along the length of the element 60. Additionally, external spacings S_1 , S_2 , etc. of the slit's pattern can be made so that more of the slit 66 is defined toward the center 68 of the element 60 as opposed to the ends 67a-b.

[0040] The angle of the slit 66 can be orthogonal to the sleeve's internal surface 62, which fits adjacent the mandrel 50. Alternatively, the angle of the slit 66 can vary relative to the internal surface 62. For example, with the external spacings S_1 , S_2 , etc. varying as shown in Fig. 4D, internal spacings of the spiral pattern would be opposite this due to the angle of the slit 66.

[0041] As best shown in the cross-sectional views of Figs. 4B-4C, for example, the slit 66 can be defined at varying angles α_1 , α_2 , etc. relative to the center 68 of the compressible packing element 60. In particular, the slit 66 toward the ends 67a-b of the compressible packing element 60 angle inward toward the element's center 68 at less acute angles α_1 (as measured from the inner dimension 62 of the packing element 60 to the outer dimension). The slit 66 defined closer to the center 68 then angles inward toward the element's center 68 at more acute angles α_2 (as measured from the inner dimension 62 of the packing element 60 to the outer dimension). This variation increases closer to the element's center 68. The slit 66 then mirrors this arrangement on the other side of the center 68 towards the opposite end of the compressible element 60.

[0042] In general, when the tool 50 is deployed and operated downhole, the packing element 60 compresses in a manner similar to a typical compression set element. Essentially, movement of one or both ends 67a-b of the element 60 toward the other tends to compress the material of the element 60. In turn, the element 60 tends to expand outwardly, which enables the element to subsequently engage a surrounding surface of a tubular, casing, borehole, etc. The expanded element 60 can then seal the annular space around the mandrel 52 and the surrounding surface.

[0043] In addition to the typical compression of the element 60, the arrangement of the slit 66 as disclosed herein helps reduce leakage paths and helps maintain the structural integrity of the compressible packing element 60. In particular, the slit 66 and the disclosed spacings S discussed above can bias setting of the element 60 towards its center.

[0044] Turning to Figs. 5A-5B, the compressible packing element 60 is shown being compressed (C) between gage rings 70a-b on the mandrel 52. Either one or both of the gage rings 70a-b may be moved on the mandrel 52 to compress (C) the element 60 and cause it to expand (E) radially outward. For instance, one gage ring 70b can be fixed to the mandrel 52. The other gage ring 70a can be moved by (or may be part of) an actuation mechanism or actuator (A) on the tool 50. The actuator (A) can be operated using hydraulic, mechanical, electric, or other actuation. For instance, the actuator (A), which is only schematically shown, can be a piston that moves one of the rings 70a toward the other. As shown in Fig. 5B, the compressed packing element 60 expands (E) radially outward so the packing element 60 can seal in a surrounding surface (not shown) of casing, tubular, borehole, or the like.

[0045] The spiral pattern to the slit 66 helps with the radial expansion (E) of the compressible packing element 60 as it is compressed (C) between the gage rings 70a-b. In this sense, the spiraled segments 69 can rotate or twist (T) relative to one another and allow the compressible element 60 to expand (E) radially outward more uniformly. Additionally, the back

angles α_1 , α_2 , etc. of the slit 66 in the depth of the compressible packing element 60 allow the segments 69 to slide and ride up (R) on each other, which allows the compressible element 60 to expand (E) more uniformly. In the end, the uniform expansion (E) of the compressible packing element 60 can mitigate the opportunities of the slit 66 to splay or widen open. Additionally, varying the slit's angle creates a cross-sectional profile in which back angles of each spiral segment 69 aids the adjoining segment 69 in ramping up on one another to create a uniform radial seal.

[0046] Although the slit 66 and the disclosed spacings S can bias setting of the element 60 towards its center 68 as discussed above with reference to Figs. 5A-5B, other configurations for biasing the setting of the element 60 can be used. For example, the slit 66 and spacings S can be configured to bias setting of the element 60 toward one end 67a-b of the element 60, away from the center 68 of the element 60, or toward some other point(s). Depending on the implementation and the type of sealing desired, such alternative biasing of the element's setting can have a number of benefits.

[0047] The compressible packing element 60 can be assembled with the slit 66 on the mandrel 52 for the tool 50 prior to shipping the tool 50 to the field. For example, the element 60 can be wrapped along the slit 66 around the mandrel 52 to form the uncompressed sleeve. At the rig site, the compressible element 60 can be removed (*e.g.*, unwound) from the mandrel 52, the continuous lines 54 along the tubing string can be secured to the mandrel 52 in a conventional manner, and the element 60 can then be rewound over the lines 54 and against the mandrel 52. The compressible packing element 60 can then be secured in place using any number of techniques or structures, such as adhesive, external sheathing, external wrap, fixtures, etc. For example, an adhesive suitable for securing the elastomer of the element 60 to a metallic material of the mandrel 52 can be applied to the requisite surfaces. Adhesive can be applied to the adjacent surfaces of the slit 66. In another example, the element 60 can be secured at each gage ring 70a-b to prevent unraveling

during run in. Still further, a sheathing, covering, or coating can be applied to the exterior of the element 60 to hold it wound in place on the mandrel 52.

[0048] In previous embodiments, the packing element 60 has been shown as being formed primarily from a unitary sleeve of material that is disposed on the mandrel 52. The packing element 60 can be composed of more than one component disposed end-to-end on the mandrel 52. For example, Figs. 6A-6B show a compressible packing element 60 being compressed (C) between gage rings 70a-b on the mandrel 52. This element 60 includes one sleeve component 61a toward one gage ring 70a and includes another sleeve component 61b toward the other gage ring 70b.

[0049] These two components 61a-b can be formed from sleeves having slits 66 with the disclosed spiral pattern. Internal ends of these two components 61a-b can abut directly end-to-end against each other. Alternatively and as shown in particular in Figs. 6A-6B, a separation ring 63 can be disposed on the mandrel 52 between the two components 61a-b. This ring 63 can be composed of the same or different material than the packing element 60. The ring 63 can be a continuous ring that slides on the mandrel 52 or can be a split ring that fits over the mandrel 52 during assembly, as long as the ring 63 allows for passage of the line 54. The ring 63 may even include angled sides to enhance the expansion of the element 50 toward the center of the element 50. As this and other embodiments show, the packing element 60 of the present disclosure can have a number of suitable configurations.

[0050] The foregoing description of preferred and other embodiments is not intended to limit or restrict the scope or applicability of the inventive concepts conceived of by the Applicants. Although features of the slit 66 have been described above as including both differential spacing (S) along the length of the element 60 as well as varied back angles (α), embodiments of the slit 66 in the element 60 may have either one of these features alone. For example, one embodiment of the element 60 may

include differential spacing (S) of the slit 66, but may lack varied back angles (α). Instead, the angle (α) of the cut to make the slit 66 may stay consistent, either being orthogonal to the surface of the element 60 along the length, angled at one angle along the length of the element 60, angled at one angle for a half-length and at a complementary angle for the other half-length of the element 60, etc. Another embodiment of the element 60 may have the varied back angles (α), but may attempt to maintain spacing (S) that is relatively consistent along the length of the element 60. These and other variations are possible.

[0051] It will be appreciated with the benefit of the present disclosure that features described above in accordance with any embodiment or aspect of the disclosed subject matter can be utilized, either alone or in combination, with any other described feature, in any other embodiment or aspect of the disclosed subject matter.

WHAT IS CLAIMED IS:

1. A downhole tool accommodating a feed-through line running along tubing, the downhole tool comprising:
 - a mandrel coupling to the tubing and accommodating adjacent passage of the feed-through line; and
 - a sleeve disposed on the mandrel and defining a slit around a circumference and along a length of the sleeve, the sleeve wrapping along the slit around the mandrel and the feed-through line and being compressible from an uncompressed state to a compressed state, the sleeve in the compressed state packing against a surface surrounding the mandrel.
2. The tool of claim 1, wherein external spacing of the slit on an exterior of the sleeve varies along the length of the sleeve.
3. The tool of claim 2, wherein the external spacing of the slit varies from a wider spacing toward a first end of the sleeve to a narrower spacing toward a center of the sleeve.
4. The tool of claim 3, wherein the external spacing varies from a second, opposite end of the sleeve toward the center in a manner complimentary to the first end toward the center.
5. The tool of claim 3, wherein internal spacing of the slit on an interior of the sleeve varies along the length of the sleeve opposite to the external spacing.
6. The tool of claim 1, wherein a cross-sectional angle of the slit from an interior to an exterior of the sleeve varies along the length of the sleeve.

7. The tool of claim 6, wherein the cross-sectional angle varies from a less acute angle toward a first end of the sleeve to a more acute angle toward a center of the sleeve.
8. The tool of claim 7, wherein the cross-sectional angle varies from a second, opposite end of the sleeve toward the center in a manner complimentary to the first end toward the center.
9. The tool of claim 1, further comprising at least one ring disposed on the mandrel and being movable thereon to compress the sleeve.
10. The tool of claim 1, wherein the sleeve comprises an elastomeric material.
11. The tool of claim 1, wherein the sleeve defines a channel on an inner dimension accommodating the feed-through line disposed against the mandrel.
12. The tool of claim 1, wherein the sleeve comprises one or more components disposed end-to-end on the mandrel.
13. The tool of claim 12, wherein the sleeve comprises at least two of the component disposed end-to-end on the mandrel, and wherein the tool comprises a ring disposed on the mandrel between the ends of the at least two components.
14. A method of assembling a downhole tool to accommodate a feed-through line running along tubing, the method comprising:
 - forming a sleeve of compressible material;
 - forming a slit around a circumference and along a length of the sleeve; and

wrapping the slit sleeve of the compressible material around a mandrel of the downhole tool.

15. The method of claim 14, wherein forming the slit around the circumference and along the length of the sleeve comprises cutting the slit in the sleeve.

16. The method of claim 14, further comprising securing the slit sleeve wrapped on the mandrel.

17. The method of claim 14, comprising:
unwrapping the slit sleeve of the compressible material from the mandrel of the downhole tool;
disposing the feed-through line adjacent the mandrel; and
rewrapping the slit sleeve of the compressible material around the mandrel and the feed-through line.

18. A method of accommodating on a downhole tool a feed-through line running along tubing, the method comprising:
unwrapping a radially slit sleeve of compressible material from a mandrel of the downhole tool;
disposing the feed-through line adjacent the mandrel; and
rewrapping the radially slit sleeve of the compressible material around the mandrel and the feed-through line.

19. The method of claim 18, wherein rewrapping the radially slit sleeve of the compressible material around the mandrel and the feed-through line comprises accommodating the feed-through line in a channel defined along an inner dimension of the sleeve.

20. The method of claim 18, further comprising securing the radially slit sleeve rewrapped on the mandrel.

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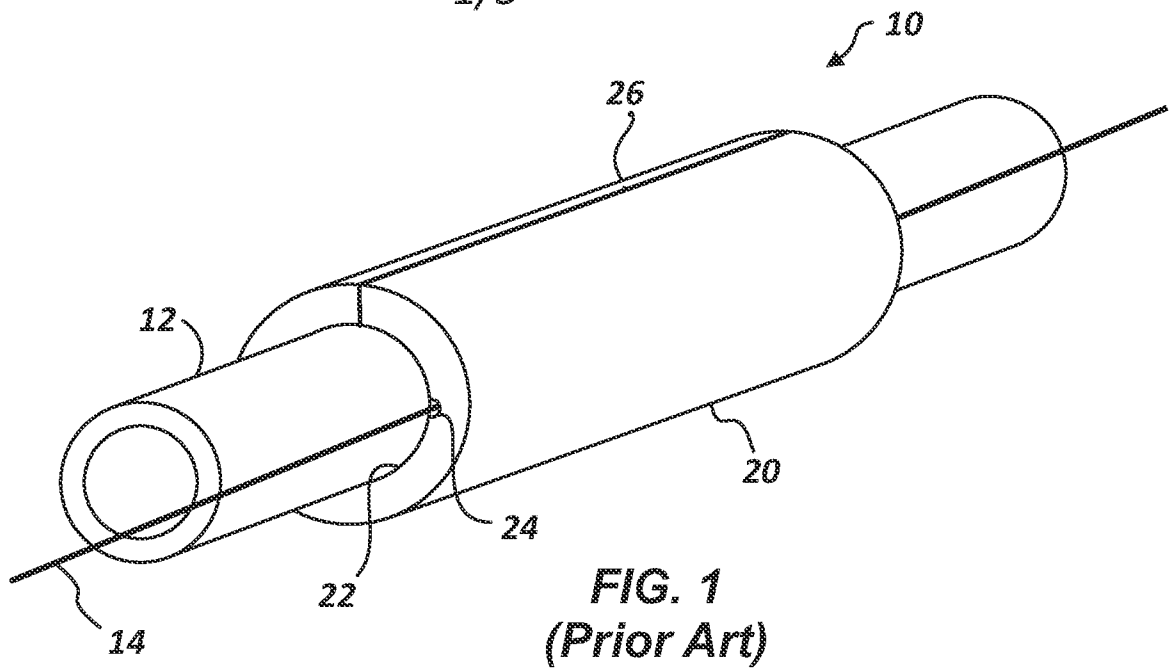


FIG. 2A
(Prior Art)

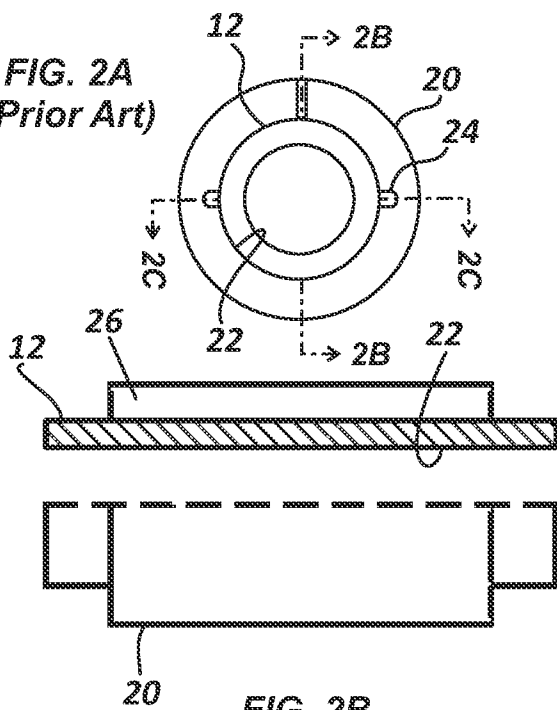


FIG. 2B
(Prior Art)

FIG. 2C
(Prior Art)

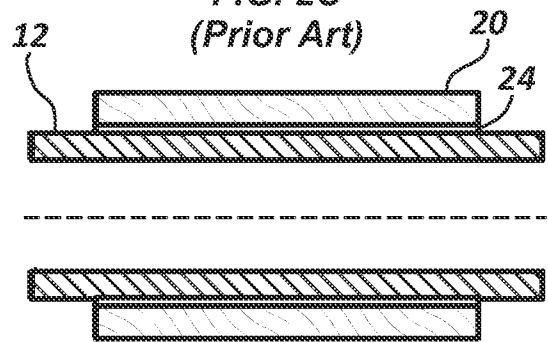
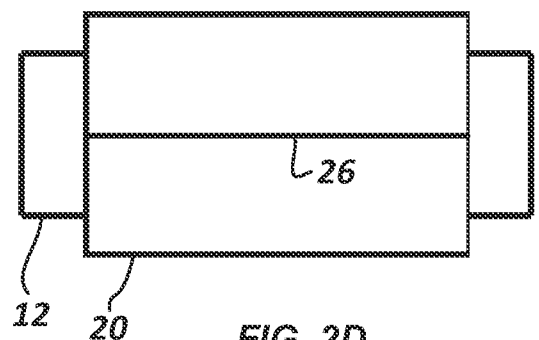
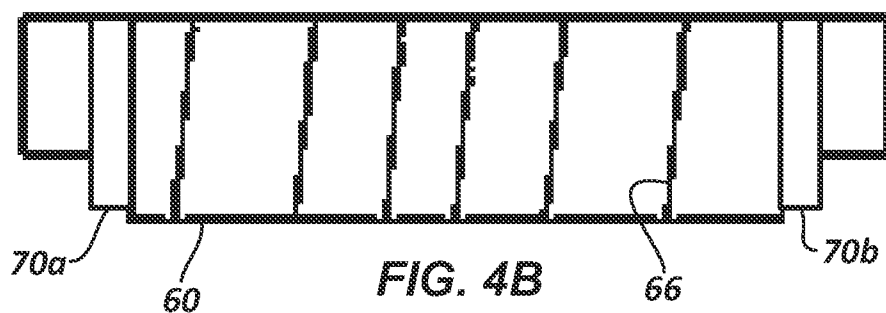
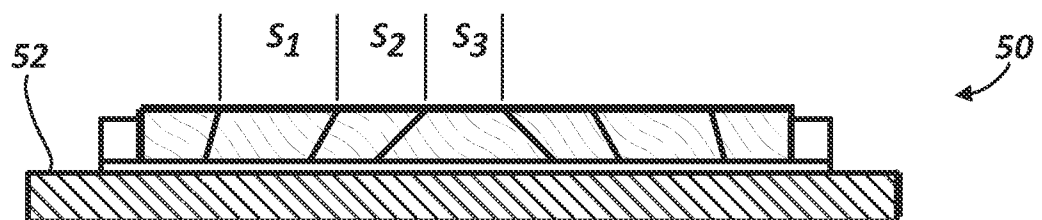
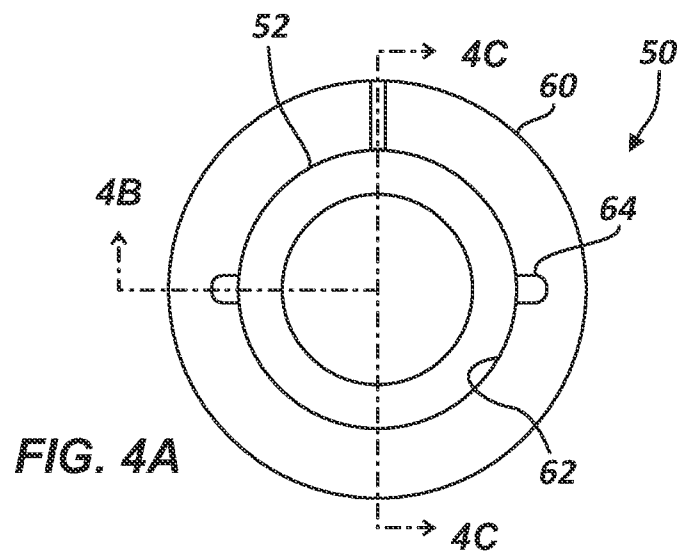
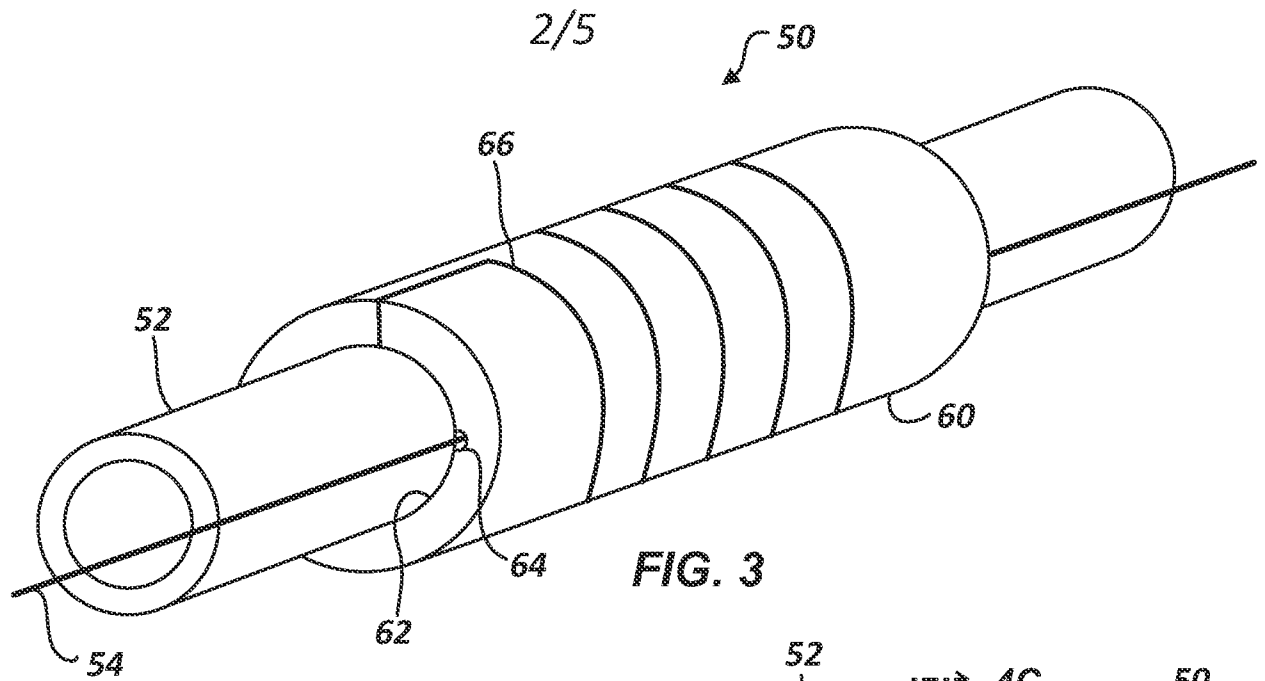


FIG. 2D
(Prior Art)



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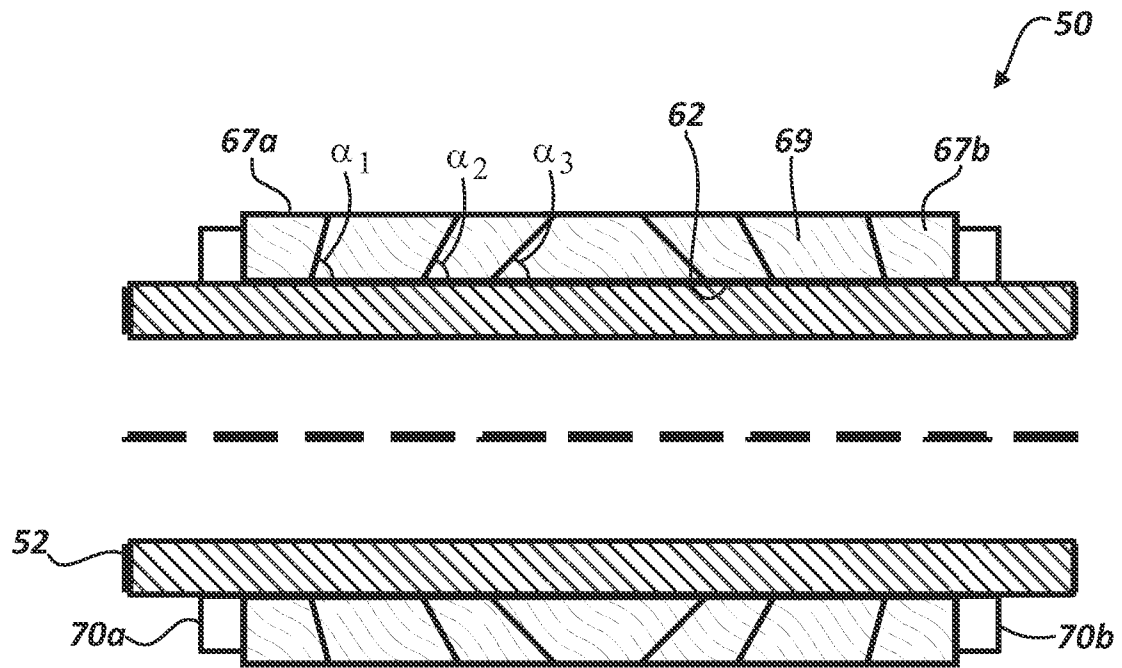


FIG. 4C

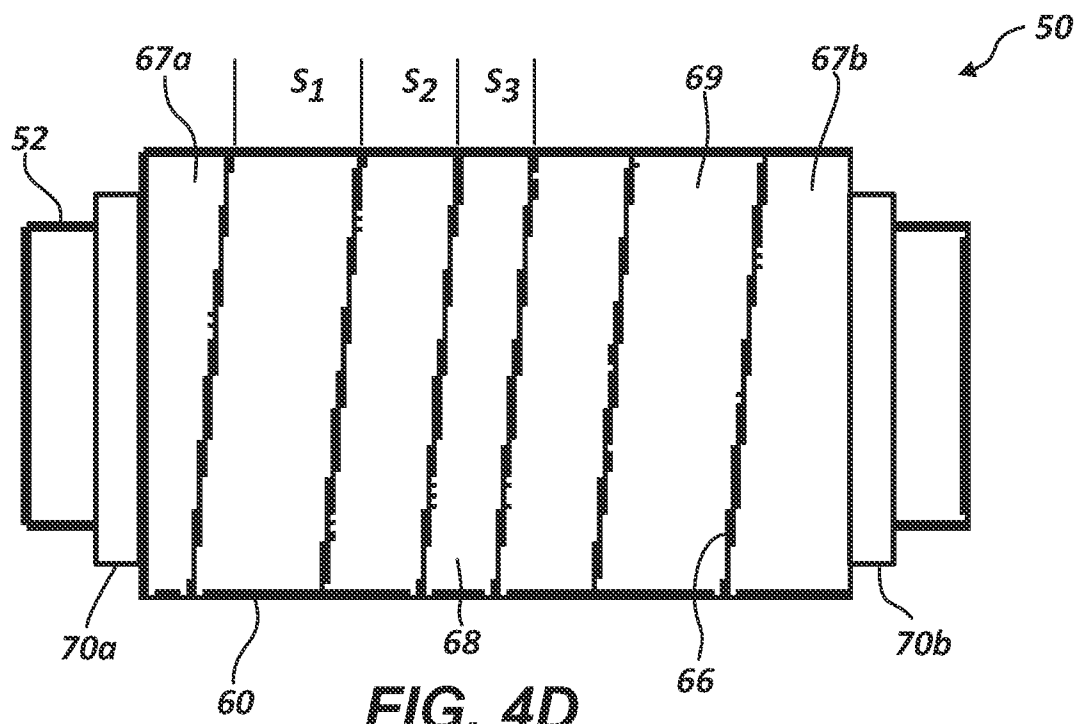


FIG. 4D

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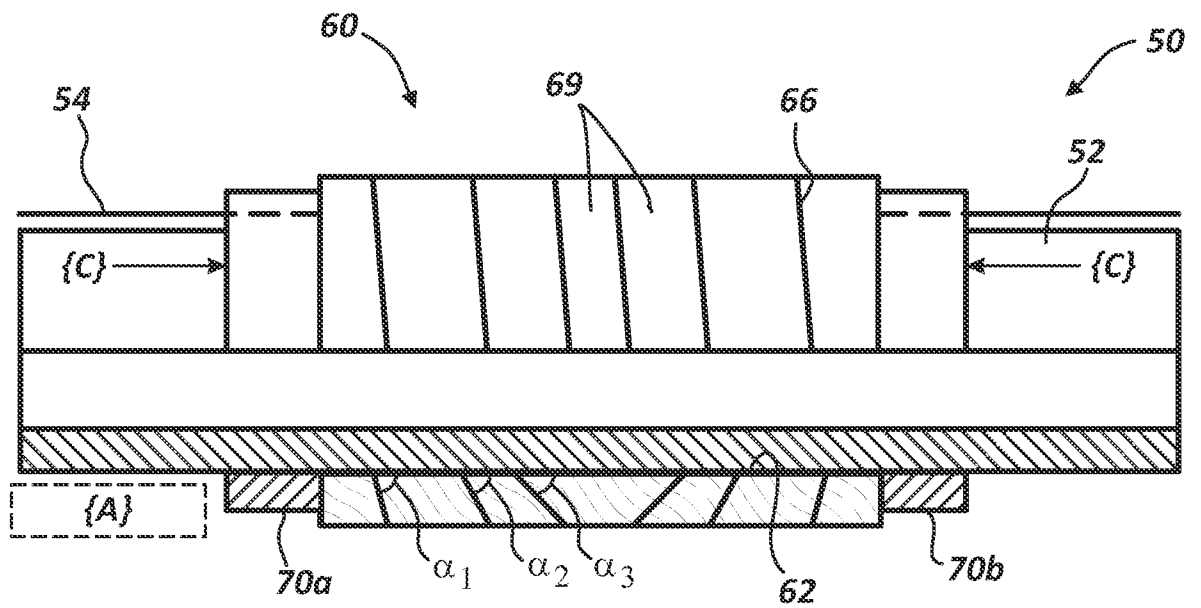


FIG. 5A

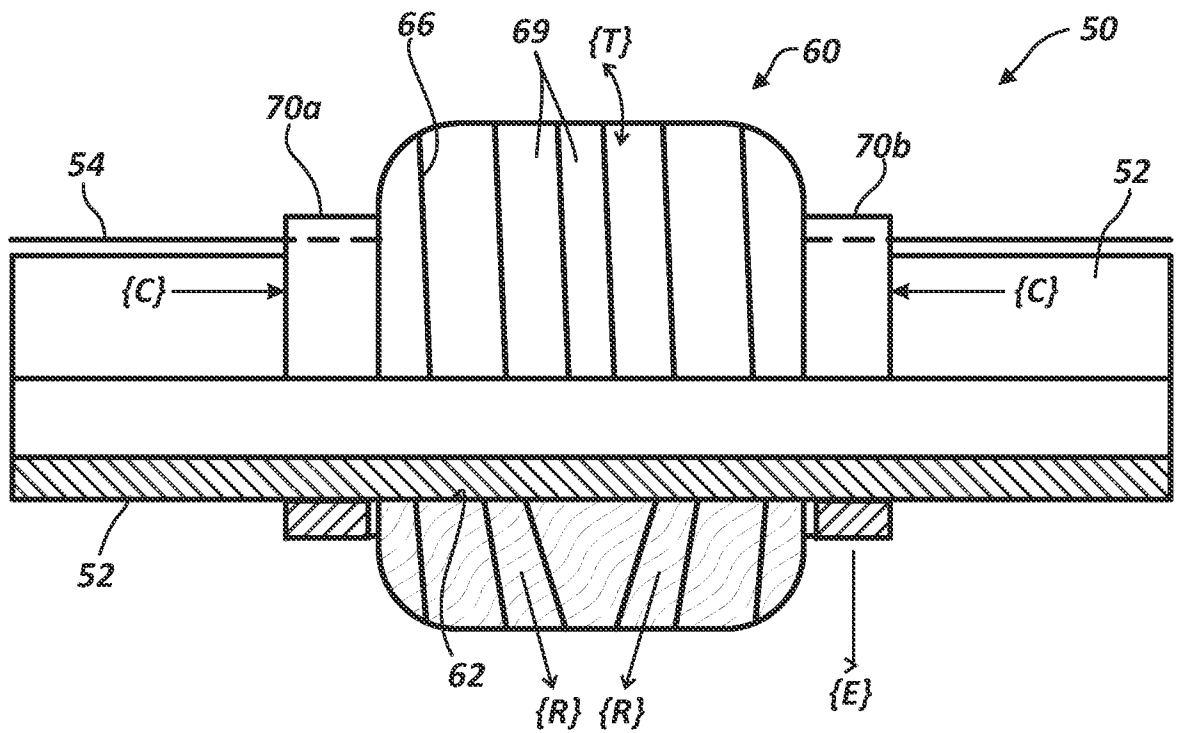
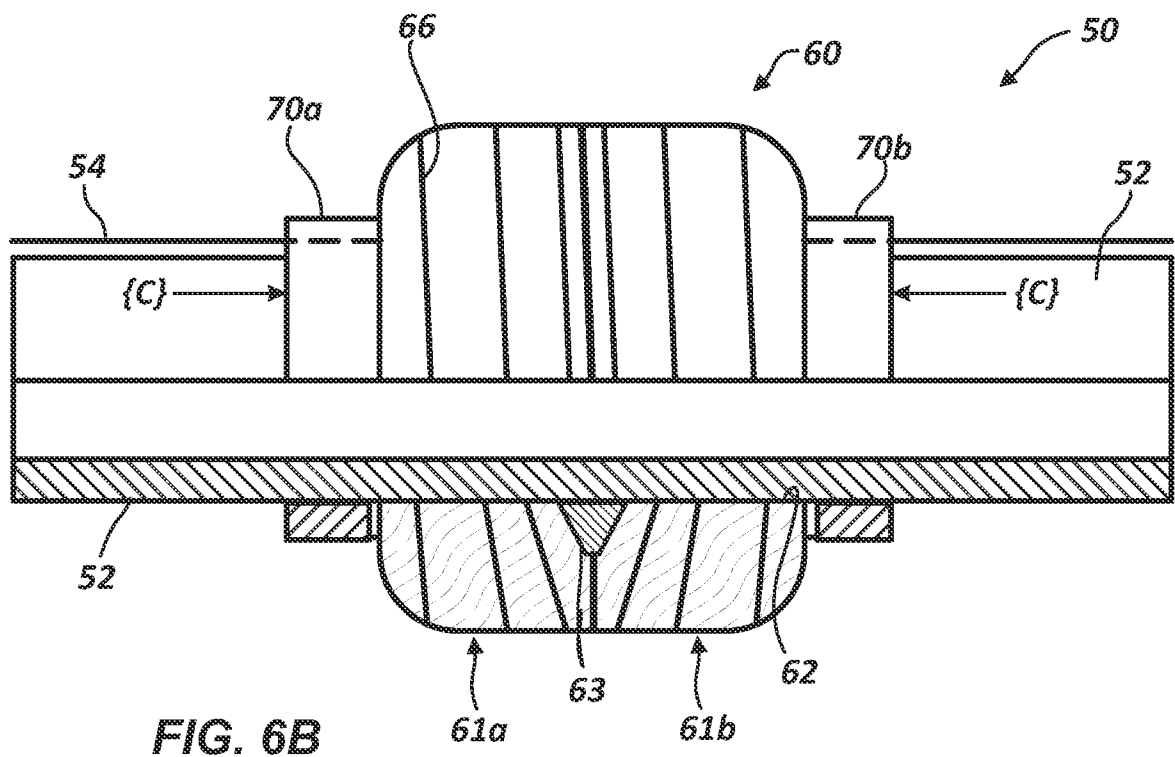
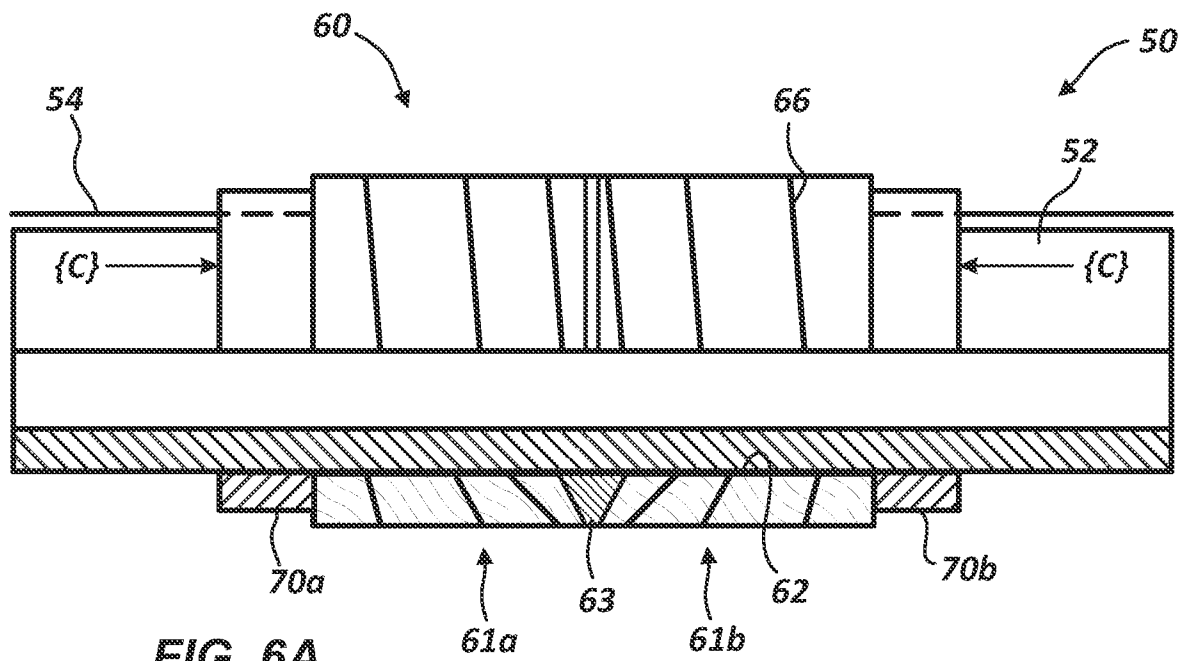


FIG. 5B

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/039558

A. CLASSIFICATION OF SUBJECT MATTER
INV. E21B33/128 E21B33/12
ADD.

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)
E21B

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2004/038167 A1 (RESLINK AS [NO]; MOEN TERJE [NO]; DYBEVIK ARTHUR H [NO]) 6 May 2004 (2004-05-06) page 12, lines 3-24 page 15, line 7 - page 17, line 9 figures 1-8	1-20
Y	US 2010/206589 A1 (CORNELISSEN ERIK KERST [NL] ET AL) 19 August 2010 (2010-08-19) paragraph [0003] paragraphs [0024] - [0028] Claim 7 paragraph [0012] figures 1-4	1-20
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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

18 November 2015

Date of mailing of the international search report

26/11/2015

Name and mailing address of the ISA/

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Kecman, Ivan

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/039558

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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A	paragraphs [0026] - [0028] figures 4-10	3-8
A	----- US 2012/055667 A1 (INGRAM GARY [US] ET AL) 8 March 2012 (2012-03-08) paragraph [0056] figures 7a, 7b	1-20
A	----- US 2010/051295 A1 (COURVILLE PERRY W [US] ET AL) 4 March 2010 (2010-03-04) paragraph [0042] paragraph [0060] paragraphs [0062] - [0063] figure 7	1-20

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International application No

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