ACTUATED PACKER ARRANGEMENT HAVING A DEGRADABLE LAYER FOR A SEAL

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Appl. No.: 13/190,843
Filed: Jul. 26, 2011

Publication Classification

Int. Cl. E21B 33/12 (2006.01)

ABSTRACT

A packer arrangement for forming a seal between an inner tubular string and an outer tubular string in a borehole includes: an outer tubular string member defining an axial flowbore and having an associated packer setting mechanism; a packer device disposed at least partially within the outer tubular string member to form a seal against an inner tubular string, the packer device including a degradable layer for temporarily and at least partially protecting the packer device; an inner tubular string member to be disposed within the flowbore of the outer tubular string member; and an actuator carried on the inner tubular string member, the actuator being operable to actuate the packer setting mechanism to set the packer device against the inner tubular string.
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BACKGROUND

Packers are used for securing production tubing inside of casing or a liner within a borehole, for example. Packers are also used to create separate zones within a borehole. Unfortunately, conventional packers and techniques for setting packers result in a reduction of usable diameter within the well. This is because the packer is carried by a conveyance tubular (such as a production tubing string) that is of smaller diameter than the tubing or casing against which it is set. The packer is then set within the annular space between the conveyance tubular and the outer tubing or casing. Once set, the usable diameter of the well (i.e., the diameter through which production fluid can flow or tools can be passed) becomes the inner diameter of the conveyance tubular. However, the components of the packer device (including slips, elastomeric seals, setting sleeves and so forth) inherently occupy space between the inner and outer tubulars. For example, a borehole having standard 21.40 lb. casing with an outer diameter of 5 inches, would have an inner diameter of 4.126 inches. It would be desirable to run into the casing a string of tubing having an outer diameter of approximately 4 inches, which would allow for a tubing string with a large cross-section area for fluid flow and tool passage. However, the presence of packer components on the outside of the tubing string will dictate that a smaller size tubing string (such as 2 7/8") be run over an inch of diameter in usable area is lost due to the presence of both the inner production tubing string and the packer device that is set within the space between the production tubing string and the casing.

SUMMARY

A packer arrangement for forming a seal between an inner tubular string and an outer tubular string in a borehole includes: an outer tubular string member defining an axial flowbore and having an associated packer setting mechanism; a packer device disposed at least partially within the outer tubular string member to form a seal against an inner tubular string, the packer device including a degradable layer for temporarily and at least partially protecting the packer device; an inner tubular string member to be disposed within the flowbore of the outer tubular string member; and an actuator carried on the inner tubular string member, the actuator being operable to actuate the packer setting mechanism to set the packer device against the inner tubular string.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a side, cross sectional view of an exemplary packer device constructed in accordance with the present invention;

FIG. 2 is a side, cross sectional view of the packer device shown in FIG. 1, now having been set;

FIG. 3 is a side, cross-sectional view of an alternative packer device constructed in accordance with the present invention;

FIG. 4 is a side, cross-sectional view of the packer device shown in FIG. 3, now with having been set;

FIG. 5 is a side, cross-sectional view of a further alternative packer device constructed in accordance with the present invention;

FIG. 6 is a side, cross-sectional view of the packer device shown in FIG. 5, now having been set;

FIG. 7 is a side, cross-sectional view of an alternative packer device constructed in accordance with the present invention and utilizing a hydraulic setting arrangement for setting the packer device;

FIG. 8 is a side, cross-sectional view of the packer device shown in FIG. 7, now having been actuated to a set position;

FIG. 9 is a side, cross-sectional view of an alternative packer device also utilizing a hydraulic setting arrangement;

FIG. 10 is a side, cross-sectional view of the packer device shown in FIG. 9, now having been actuated to a set position;

FIG. 11 is a side, cross-sectional view of a further exemplary packer device, which incorporates a ductile, radially expandable tube;

FIG. 12A is a side, cross-sectional view of a packer device generally in accordance with FIG. 1, but with a protective layer provided for a seal element;

FIG. 12B is a quarter-sectional view of another packer device embodiment disclosed herein.

DETAILED DESCRIPTION

FIGS. 1 and 2 illustrate an exemplary borehole 10 that has been drilled through the earth 12. The borehole 10 is lined with a string of casing 14, 16 that are depicted. A casing coupler 18 interconnects the casing sections 14, 16 to form a casing string 17 that defines a central bore 19 along its length. Cement 20 surrounds the casing sections 14, 16 and casing coupler 18. It is noted that the casing coupler 18 has a greater diameter than the casing sections 14, 16 and is secured to each of the casing sections 14, 16 via threaded connections 22, 24, respectively.

The casing coupler 18 includes an axial bore 26 for passage of tools and fluid through the casing coupler 18. The bore 26 has an enlarged diameter portion 28. A packer device 30 is disposed within the enlarged diameter portion 28. The packer device 30 includes a cylindrical elastomeric packer sealing element 32 and a cylindrical setting sleeve 34. The setting sleeve 34 is a compression member that is axially moveable within the enlarged diameter portion 28 of the bore 26. The setting sleeve 34 features an axial bore 36 with an engagement profile 38 within. A ratchet-style body lock ring assembly 37 of a type known in the art, is associated with the outer radial diameter surface of the setting sleeve 34. The body lock ring assembly 37 provides for limited one-way movement of the setting sleeve 34 with respect to the surrounding casing coupler 18.

FIGS. 1 and 2 depict actuation of the packer device 30 to create a seal between the casing string 17 and a string of production tubing 40, the lower end of which is visible in FIG. 2. The lower end of the production tubing string 40 includes a setting tool 42 for actuation of the packer device 30. In FIG. 1, the packer device 30 is in an initial, unset position. In one embodiment, the setting tool 42 includes a cylindrical tool body 44 having a plurality of collets 46 extending axially therefrom. Each of the collets 46 carries a radially enlarged portion 48 that presents a stop shoulder 50 and a tapered camming surface 52. The enlarged portion 48 is shaped and sized to fit within the engagement profile 38 of the setting sleeve 34.
To activate the packer device 30, the production tubing string 40 and setting tool 42 are inserted into the casing string 17. The tapered camming surface 52 of each collet 46 will contact the upper ends of the sealing element 32 and the setting sleeve 34 and deflect the collet 46 radially inwardly. When the radially enlarged portion 48 of each collet 46 becomes aligned with the engagement profile 38 of the setting sleeve 34, each collet 46 will snap radially outwardly so that the radially enlarged portion 48 becomes disposed within the engagement profile 38, as shown in FIG. 2. Once the setting tool 42 is attached to the setting sleeve 34 in this manner, the tubing string 40 is then pulled upwardly to cause the setting sleeve 34 to be moved axially upwardly within the enlarged diameter portion 28 of the bore 26. The collets 46 are not disengaged from the engagement profile 38 due to abutting contact between the stop shoulder 50 and the upper end 54 of the profile 38. The sealing element 32 is thereby axially compressed by the setting sleeve 34 and, when axially compressed, will be extruded radially inwardly against the tool body 44 of the production tubing string 40. The body lock ring assembly 37 will prevent the setting sleeve 34 from moving back downwardly with respect to the surrounding casing coupler 18, thereby preventing the packer device 30 from becoming unset.

Because the components of the packer device 30 are retained within an enlarged diameter portion 28 of the casing coupler 18, the gap between the exterior of the tubing string 40 and the interior of the casing string 17 can be quite small. For example, in a casing string made up of 35.5 lbs. Casing sections with an external diameter of 5 inches, an interior diameter of 4.126 inches would be available. With the large bore, external packer arrangement described above, it would be possible to insert a tubing string 17 having a diameter approximating 4 inches, rather than a smaller diameter tubing string (i.e., 2½”). In fact, the use of a larger diameter tubing string is desirable for two reasons. First, the resulting available cross-sectional flow and work bore area of the tubing string 17 will be larger. Second, the sealing element 32 of the packer device 30 can more easily and securely seal against the larger diameter tubing string 17.

FGS. 3 and 4 illustrate an alternative embodiment of the invention wherein a packer device 30 has a sealing element 32 and a setting sleeve assembly 60. The setting sleeve assembly 60 includes an inner setting sleeve member 62 having an external helical thread 64 and an internal helical thread 66 that is formed on the interior of the enlarged diameter portion 28. It is noted that the external and internal threads 64, 66 are interengaged with one another in a well-known manner such that rotation of the sleeve member 62 within the casing coupler 18 will move the sleeve member 62 axially within the coupler 18. One or more key slots 68 are located on the radial interior of the sleeve member 62.

In FIG. 3, the packer device 30 is in an unset, initial position. In FIG. 4, a production tubing string 40 has been inserted into the casing string 17. A setting component 70 is secured to the lower end of the production tubing string 40 and presents radially extending keys 72 that are shaped and sized to fit within the key slots 68. It is noted that the keys 72 are preferably spring-biased radially outwardly from the body of the setting component 70 so that they may be compressed radially inwardly as needed for disposal down through the casing string 17 and to pop radially outwardly upon encountering the key slots 68. When the keys 72 are located within the key slots 68, the inner sleeve member 62 is secured rotationally with respect to the setting component 70 such that rotating the tubing string 40 and setting component 70 will rotate the sleeve member 62. In order to set the packer device 30, the tubing string 40 is rotated at the surface to cause the sleeve member 62 to move axially upwardly with respect to the casing coupler 18, thereby radially compressing the sealing element 32 and causing it to seal against the tubing string 40. In this embodiment, no body lock ring is required to maintain the packer device 30 in the set position. The inward compressive force exerted by the sealing element 32 upon the outer radial surface of the tubing string 40 should be sufficient to prevent counter-rotation of the tubing string 40 within the casing string 17 that might cause the packer device 30 to become unset.
metallic sealing element is employed, the sealing element may be a bellow-type seal or a hydroformed seal or ring element. Additionally, a metal-to-metal seal may incorporate toothed slips, of a type known in the art, or other mechanisms for creating a biting engagement between the tubing string 40 and the surrounding casing string 17.

Currently, each of the packer devices 30, 30' and 30" are permanently set packer devices. They may be removed from the borehole, if desired, by use of a suitable milling tool, as is known in the art.

Figs. 7 and 8 illustrate a further exemplary packer device 100 that employs an energy source that is contained within the casing string 17 prior to disposing the tubing string 40 into the casing string 17. The enlarged diameter chamber 28 of the casing coupler 18 contains an outer collar 102 and an inner collar 104. The inner collar 104 is disposed radially within the outer collar 102, and a chamber 106 is defined radially between the two collars 102, 104. Flanged end portions 108 and seals 110 are provided for each of the collars 102, 104. The outer collar 102 presents an upper axially end portion 112 that lies in contact with the sealing element 32. A recess 114 is inscribed within the interior radial surface 116 of the outer collar 102. An annular seal member 118 is fixedly secured to the inner collar 104 and is, in turn, secured to a split ring, or C-ring member 120. In the unset position, depicted in Fig. 7, the split ring 120 resides within the recess 114 of the outer collar 102. As noted, the chamber 106 is defined radially between the inner and outer collars 102, 104, at its upper end by seal 110, and at its lower end by seal member 118. A split ring actuator 122 (visible in Fig. 7) is operably interconnected with the split ring 120. The split ring actuator 122 preferably comprises a programmable electronic transceiver that is designed to receive a triggering signal from a transmitter. Signal transmitter 124 is incorporated within the tubing string 40. In one currently preferred embodiment, the signal transmitter 124 may comprise an RFID (radio frequency identification) tag or chip that is designed to emit a triggering signal upon passing within a certain proximate distance of the actuator 122. The actuator 122 is operably associated with the split ring 120 to retract the split ring 120 radially inwardly and out of the recess 114 upon receipt of the signal from the transmitter 124. Radial refraction of the split ring 120 may be done by the actuator mechanically, magnetically, or using other suitable known techniques.

The chamber 106 may be an atmospheric chamber or a more highly pressurized chamber, which will create a pressure differential across the seal member 118 which will urge the end portion 112 of the outer collar 102 toward the sealing element 32 and a set position. In variations on this embodiment, the chamber 106 could be replaced with a mechanical spring to serve as an energy source to bias the outer collar 102 toward the sealing element 32. Additionally, the transmitter 124 and actuator 122 could be replaced by a mechanical trigger arrangement wherein the spring is mechanically released from a compressed state by engaging a release latch for the spring with an engagement member within the tubing string 40.

In operation, the packer device 100 is in the initially unset position shown in Fig. 7. The tubing string 40 is lowered into the casing string 17 until the transmitter 124 is located proximate the actuator 122. The triggering signal is received by the actuator 122, which then releases the split ring 120 from the recess 114. If desired, a delay could be incorporated into the programming of the actuator 122 such that a predetermined period of time elapses between the time the triggering signal is received by the actuator 122 and the split ring 120 is released from the recess 114. When the split ring 120 is released from the recess 114, fluid pressure within the chamber 106 will urge the outer collar 102 axially upwardly so that the upper end 112 will compress the sealing element 32. The sealing element 32 will be deformed radially inwardly to seal against the tubing string 40, as depicted in Fig. 8 to create a seal.

Referring now to FIGS. 9 and 10, a further exemplary packer device 130 is depicted which utilizes hydraulic setting via the tubing string 40. The sealing element 32 is retained within the chamber 28 along with a setting piston 132. The setting piston 132 features an enlarged compression head portion 134 that abuts the sealing element 32 and a reduced diameter stem portion 136 that extends downwardly from the head portion 134. A ratchet mechanism 138 is located at its lower end of the stem portion 136 and operates in the manner of a body lock ring to ensure one-way sequential movement of the setting piston 132 with respect to the surrounding casing coupler 18.

A fluid chamber 140 is defined between the setting piston 132 and the casing string 17 within the enlarged chamber 28. Fluid flow ports 142 are disposed through the setting piston 132 to permit fluid communication between the fluid chamber 140 and the interior flowbore 144 of the setting piston 132. Fluid seals 146 are provided between the setting piston 132 and the casing coupler 18 to ensure fluid tightness of the fluid chamber 140.

The lower end of the tubing string 40 is closed off by a plug 148. The plug 148 is preferably a temporary or removable plug that can be removed to allow flow through the tubing string 40 at a later point during production operations. Ports 150 are disposed through the side of the tubing string 40.

In operation, the packer device 130 is initially in the unset position depicted in FIG. 9. The tubing string 40 is then disposed into the casing string 17 until the ports 150 of the tubing string 40 are generally aligned with the fluid flow ports 142 in the setting piston 132. The interior flowbore 152 of the tubing string 40 is then pressurized so that fluid is flowed through the aligned ports 150 and 142 and into the fluid chamber 140. The setting piston 132 is urged upwardly by the fluid pressure so that the enlarged head portion 134 compresses the sealing element 32. Axial compression of the sealing element 32 causes the sealing element 32 to deform radially inwardly and seal against the tubing string 40, as depicted in FIG. 10. The ratchet mechanism 138 ensures that the packer device 130 remains in the set position.

FIG. 11 depicts a further exemplary embodiment of the invention wherein a sealing element 200 is contained within the chamber 28 of the casing coupler 18 and an inflatable, or radially expandable, ductile tube 201 is made up into the production tubing string 40. The ductile tube 201 is formed of a material that permits the tube 201, or portions thereof, to be deformed radially outwardly. One such material is a nickel alloy. To create a seal, the ductile tube 201 is inflated or expanded radially outwardly until its radially outer surface is brought into sealing contact with the sealing element 200. The ductile tube 201 can be inflated or expanded radially outwardly using a number of techniques for radially expanding ductile tubular members. One technique for inflating the ductile tube 201 is to seat a dart, ball, or other plug member 202 upon a seat 204 to seal off the flowbore 152 of
the tubing string 40 below the ductile tube 201. Fluid pressure is then increased within the flowbore 152 above the plug member 202 to cause the ductile tube 201 to expand radially outwardly, as illustrated in FIG. 11. In this embodiment, as well, the plug member 202 may be a temporary or removable plug member. Alternatively, a mechanical means, such as a suitable swaging instrument, can be used to radially expand the ductile tube 201 radially outwardly.

[0036] The sealing element 200 may be a metallic sealing element or a non-metallic sealing element. In one embodiment, the sealing element 200 is an elastomeric sealing element. In another embodiment, the sealing element 200 is a mechanical sealing element and contains toothed portions to form a biting engagement with the ductile tube 201. The design of the sealing element 200 will preferably provide fluid sealing and mechanical retention between the inflatable tubing 201 and the casing coupler 18. The seating contact between the ductile tube 201 and the sealing element 200 forms a retention device between the tubing string 40 and the surrounding casing string that is capable of withstanding high axial tubing loads.

[0037] Those of skill in the art will appreciate that the present invention provides a novel borehole packer arrangement as well as a borehole production system that includes an outer tubular string having an enlarged diameter chamber portion; an inner tubular string; and a packer device disposed at least partially within the enlarged chamber to form a seal against the inner tubular string.

[0038] The present invention also provides methods of establishing a seal between inner and outer tubular string members within a borehole wherein a packer device is disposed within an enlarged diameter chamber portion of an outer tubular string. The outer tubular string, such as a string of casing or liner, is run into a borehole and cemented in place. At this point the packer device is in an unset position. Next, the inner tubular string is run into the outer tubular string to a predetermined depth or position within the outer string. The predetermined depth or position will typically correspond to the proper location of a tool, such as a production nipple, inside the outer tubular string. The packer device is then actuated from an unset to a set position to form a seal against a member of the inner tubular string.

[0039] In each of the embodiments hereof, a disintegratable, dissolvable, corrosible, decomposable, or otherwise easily defeatable protector layer may be employed, for example, a protective layer 205 is shown in FIG. 12A. With the exception of protective layer 205, FIG. 12A exactly resembles FIG. 1, and the description given above is therefore applicable also to FIG. 12A. In this embodiment, the chamber portion 28 is provided with a radial depth greater than a radial thickness of the seal element 32 in order to enable the application of the protective layer 205 for the seal element 32. As illustrated, the layer 205 is radially inwardly disposed of the seal element 32. In one embodiment, the layer is within the recess 28. The protective layer 205 is a degradable layer whose purpose is to temporarily protect the seal element 32. “Degradable” is intended to mean that the layer is disintegratable, dissoluble, corrosible, or otherwise easily removable. It is to be understood that any use herein of the term “degrade”, or any of its forms, incorporates the stated meaning.

[0040] In one embodiment, for example, the layer 205 is removed by exposure to a downhole fluid, such as water, oil, acid, etc. After the layer 205 has been removed, the packer device 30 would operate as described above with respect to FIGS. 1 and 2, for forming a seal as shown in FIG. 2. It is to be appreciated that any of the other embodiments described herein could be similarly modified in order to include a degradable layer for temporarily protecting the corresponding seal element in each embodiment.

[0041] Another embodiment is shown in FIG. 12B. Specifically, a packer arrangement 500 includes a casing pup 502 and a packer mandrel 504 for setting a seal element 506 located in a cavity or chamber 508 of the casing pup 502. The seal element 506 is initially protected by a degradable layer 510, which substantially resembles the layer 205 described above. After degrading the layer 510, an arm 512 carrying a seal engagement member 514 is actuated into engagement with the seal element 506. For example, the packer mandrel 504 include a wedge-like, conical, frustoconical, or otherwise tapered surface and be actuated toward the arm 512, or vice-versa, for urging the seal engagement member 514 radially toward the seal element 506. For example, in another embodiment a piston could actuate the seal engagement member 514 into the packer mandrel 504. The seal engagement member 514 includes a plurality of radially extending pigs 516 for “biting” into the seal element 506, thereby setting the seal element and reducing extrusion thereof. The arm 512 could include a body lock 518 for allowing movement of the member 514 in one direction with respect to the tapered surface of the mandrel 504, but not the other direction, thereby locking the member 514 in place once actuated.

[0042] Materials appropriate for the purpose of degradable protective layers as described herein are lightweight, high-strength metallic materials. Examples of suitable materials and their methods of manufacture are given in United States Patent Publication No. 2011/0135953 (Xu et al.), which Patent Publication is hereby incorporated by reference in its entirety. These lightweight, high-strength and selectively and controllably degradable materials include fully-dense, sintered powder compacts formed from coated powder materials that include various lightweight particle cores and core materials having various single layer and multilayer nanoscale coatings. These powder compacts are made from coated metallic powders that include various electrochemically-active (e.g., having relatively higher standard oxidation potentials) lightweight, high-strength particle cores and core materials, such as electrochemically active metals, that are dispersed within a cellular nanomatrix formed from the various nanoscale metallic coating layers of metallic coating materials, and are particularly useful in borehole applications. Suitable core materials include electrochemically active metals having a standard oxidation potential greater than or equal to that of Zn, including as Mg, Al, Mn or Zn alloys or combinations thereof. For example, Mg—Al—X alloys may include, by weight, up to about 85% Mg, up to about 15% Al and up to about 5% X, where X is another material. The core material may also include a rare earth element such as Sc, Y, La, Ce, Pr, Nd or Er, or a combination of rare earth elements. In other embodiments, the materials could include other metals having a standard oxidation potential less than that of Zn. Also, suitable non-metallic materials include ceramics, glasses (e.g., hollow glass microspheres), carbon, or a combination thereof. In one embodiment, the material has a substantially uniform average thickness between dispersed particles of about 50 nm to about 5000 nm. In one embodiment, the coating layers are formed from Al, Ni, W or Al2O3, or combinations thereof.
embodiment, the coating is a multi-layer coating, for example, comprising a first Al layer, a Al₂O₃ layer, and a second Al layer. In some embodiments, the coating may have a thickness of about 25 nm to about 2500 nm.

[0043] These powder compacts provide a unique and advantageous combination of mechanical strength properties, such as compression and shear strength, low density and selecteable and controllable corrosion properties, particularly rapid and controlled dissolution in various borehole fluids. The fluids may include any number of ionic liquids or highly polar fluids, such as those that contain various chlorides. Examples include fluids comprising potassium chloride (KCl), hydrochloric acid (HCl), calcium chloride (CaCl₂), calcium bromide (CaBr₂) or zinc bromide (ZnBr₂). For example, the particle core and coating layers of these powders may be selected to provide sintered powder compacts suitable for use as high strength engineered materials having a compressive strength and shear strength comparable to various other engineered materials, including carbon, stainless and alloy steels, but which also have a low density comparable to various polymers, elastomers, low-density porous ceramics and composite materials.

[0044] While one or more embodiments have been shown and described, modifications and substitutions may be made thereto without departing from the spirit and scope of the invention. Accordingly, it is to be understood that the present invention has been described by way of illustrations and not limitation.

1. A packer arrangement for forming a seal between an inner tubular string and an outer tubular string in a borehole, the packer arrangement comprising:
   an outer tubular string member defining an axial flowbore and having an associated packer setting mechanism;
   a packer device disposed at least partially within the outer tubular string member to form a seal against an inner tubular string, the packer device including a degradable layer for temporarily and at least partially protecting the packer device;
   an inner tubular string member to be disposed within the flowbore of the outer tubular string member; and
   an actuator carried on the inner tubular string member, the actuator being operable to actuate the packer setting mechanism to set the packer device against the inner tubular string.

2. The packer arrangement of claim 1 wherein:
   the packer setting mechanism comprises:
   a setting member having a generally cylindrical body defining an axial bore, the axial bore of the setting member having a ramped surface to contact the packer device and an engagement profile; and
   the actuator comprises a collet to engage the engagement profile of the setting member to actuate the packer setting mechanism by urging the ramped surface of the setting member axially against the packer device.

3. The packer arrangement of claim 2 wherein the setting member is further axially moveable within the outer tubular string member between a first position, wherein the packer device is not set, and a second position, wherein the packer device is set.

4. The packer arrangement of claim 3 further comprising a body lock ring assembly to provide for one-way movement of the setting member with respect to the outer tubular string member.

5. The packer arrangement of claim 1 wherein:
   the packer setting mechanism comprises:
   an energy source operable to set the packer device against the inner tubular string member;
   a transceiver to receive a triggering signal and, in response to said signal, activating the energy source to set the packer device; and
   the actuator comprises a signal transmitter to provide a triggering signal to the transceiver.

6. The packer arrangement of claim 5 wherein the signal transmitter further comprises a radio frequency identification device.

7. The packer arrangement of claim 5 wherein the packer setting mechanism further comprises:
   a setting member moveably disposed with respect to the outer tubular member and having an end portion to contact the packer device; and
   wherein the collar is moved axially with respect to the outer tubular member by the energy source.

8. The packer arrangement of claim 7 wherein the packer setting mechanism further comprises a split ring that resides within a recess and which is radially removed from the recess upon receipt of the triggering signal by the transceiver.

9. The packer device of claim 5 wherein the energy source comprises a fluid chamber.

10. The packer device of claim 5 wherein the energy source comprises a mechanical spring.

11. The packer device of claim 1 wherein the degradable layer is disposed within the outer string member.

12. The packer device of claim 1 wherein the degradable layer is removed before the packer device is set against the inner tubular string.

13. The packer arrangement of claim 7 wherein the setting member is initially retained against movement by a releasable lock.

14. The packer arrangement of claim 13 further comprising a trigger arrangement for selectively releasing the lock to permit the spring to move the setting member to actuate the sealing element to the set position.

15. The packer arrangement of claim 14 wherein the trigger arrangement comprises a transceiver that releases the lock upon receipt of a trigger signal.

16. The packer arrangement of claim 15 wherein the trigger arrangement further comprises a signal transmitter associated with the inner tubular string, the signal transmitter transmitting a trigger signal to the transceiver.

17. The packer arrangement of claim 16 wherein the signal transmitter comprises an RFID chip and the transceiver comprises an RFID reader.

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