

SLIP RING EMPLOYING RADially OFFSET SLOT

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to U.S. Application Serial No. 17/392,564, filed on August 3, 2021, entitled "SLIP RING EMPLOYING RADially OFFSET SLOT," commonly assigned with this application and incorporated herein by reference in its entirety.

BACKGROUND

[0002] A typical sealing assembly (e.g., packer, bridge plug, etc.) generally has one or more sealing elements or "rubbers" that are employed to provide a fluid-tight seal radially between a mandrel of the sealing assembly and the casing or wellbore into which the sealing assembly is disposed. Such a sealing assembly is commonly conveyed into a subterranean wellbore suspended from tubing extending to the earth's surface.

[0003] To prevent damage to the sealing elements while the sealing assembly is being conveyed into the wellbore, the sealing elements are carried on the mandrel in a relaxed or uncompressed state in which they are radially inwardly spaced apart from the casing. When the sealing assembly is set, the sealing elements radially expand (e.g., both radially inward and radially outward), thereby sealing against the mandrel and the casing and/or wellbore. In certain embodiments, the sealing elements are axially compressed between element retainers straddling the sealing elements on the seal assembly, which in turn radially expand the sealing elements. In other embodiments, one or more swellable sealing elements are axially positioned between the element retainers, the swellable sealing elements configured to radially expand when subjected to one or more different activation fluids.

[0004] The seal assembly often includes one or more slip rings, which grip the casing and prevent movement of the seal assembly axially within the casing after the sealing elements have been set. Thus, if weight or fluid pressure is applied to the seal assembly, the slip rings resist the axial forces on the seal assembly produced thereby, and prevent axial displacement of the seal assembly relative to the casing and/or wellbore.

BRIEF DESCRIPTION

[0005] Reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

[0006] FIG. 1 illustrates a well system designed, manufactured, and operated according to one or more embodiments of the disclosure, the well system including a sealing tool including a sealing assembly designed, manufactured, and operated according to one or more embodiments of the disclosure;

[0007] FIGs. 2A through 2D illustrate alternative views of one embodiment of a slip ring designed, manufactured, and operated according to an embodiment of the disclosure;

[0008] FIGs. 3A through 3D illustrate alternative views of an alternative embodiment of a slip ring designed, manufactured, and operated according to an embodiment of the disclosure;

[0009] FIGs. 4A through 4D illustrate alternative views of an alternative embodiment of a slip ring designed, manufactured, and operated according to an embodiment of the disclosure;

[0010] FIGs. 5A through 5D illustrate alternative views of an alternative embodiment of a slip ring designed, manufactured, and operated according to an embodiment of the disclosure;

[0011] FIGs. 6A through 6D illustrate alternative views of an alternative embodiment of a slip ring designed, manufactured, and operated according to an embodiment of the disclosure; and

[0012] FIGs. 7A and 7B illustrate various different deployment states for a sealing assembly designed, manufactured, and operated according to an embodiment of the disclosure.

DETAILED DESCRIPTION

[0013] In the drawings and descriptions that follow, like parts are typically marked throughout the specification and drawings with the same reference numerals, respectively. The drawn figures are not necessarily to scale. Certain features of the disclosure may be shown exaggerated in scale or in somewhat schematic form and some details of certain elements may not be shown in the interest of clarity and conciseness. The present disclosure may be implemented in embodiments of different forms.

[0014] Specific embodiments are described in detail and are shown in the drawings, with the understanding that the present disclosure is to be considered an exemplification of the principles of the disclosure, and is not intended to limit the disclosure to that illustrated and described herein. It is to be fully recognized that the different teachings of the embodiments discussed herein may be employed separately or in any suitable combination to produce desired results.

[0015] Unless otherwise specified, use of the terms “connect,” “engage,” “couple,” “attach,” or any other like term describing an interaction between elements is not meant to limit the interaction to direct interaction between the elements and may also include indirect interaction between the elements described. Unless otherwise specified, use of the terms “up,” “upper,” “upward,” “uphole,” “upstream,” or other like terms shall be construed as generally toward the surface of the ground; likewise, use of the terms “down,” “lower,” “downward,” “downhole,” or other like terms shall be construed as generally toward the bottom, terminal end of a well, regardless of the wellbore orientation. Use of any one or more of the foregoing terms shall not be construed as denoting positions along a perfectly vertical axis. Unless otherwise specified, use of the term “subterranean formation” shall be construed as encompassing both areas below exposed earth and areas below earth covered by water such as ocean or fresh water.

[0016] The present disclosure has acknowledged that typical c-ring slip rings, which often contain a single axial slot therein (e.g., aligned with Figs a centerline (C_L) of the slip ring), do not provide 360-degree contact between the packer and the surrounding tubular when in the radially enlarged state. Specifically, as the axial slot widens when the slip ring moves from the radially reduced state to the radially enlarged state, an exposed region exists where there is no contact between the packer and the surrounding tubular. The present disclosure has further acknowledged that the exposed region may cause the packer to cantilever within the surrounding tubular, as well as creates misalignment between related upper and lower c-ring slip rings, which are both undesirable.

[0017] Based upon the foregoing acknowledgments, the present disclosure has recognized that the undesirable cantilever effect may be reduced, if not eliminated, if there is 360-degree contact between the packer and the surrounding tubular when the slip ring is in the radially enlarged state. The present disclosure has further recognized that the 360-degree contact may be achieved with a slip ring employing a slot that is misaligned with the centerline (C_L) of the slip ring. For example, the present disclosure has recognized that the 360-degree contact may be achieved using a slip ring employing a slot extending between a first end and a second opposing end of a ring member, wherein a first portion of the slot located at the first end and a second portion of the slot located at the second opposing end are radially offset from one another by at least 15-degrees. The slot may take on many different shapes while achieving the discussed radially offset, including both non-linear and linear slots. In at least one embodiment, the slot is a non-

linear slot, such as a Z-shaped slot, an S-shaped slot, a spiral shaped slot, or a helical shaped slot, among others. In yet another embodiment, the slot is a linear slot, such as a linear slot extended from the first end to the second opposing end at an angle.

[0018] Therefore, a slip ring designed, manufactured, and used according to the present disclosure will allow for 360-degree contact between the packer and the surrounding tubular, even when in the radially enlarged state, without the need for a full barrel style type external slip ring. Full barrel style type external slip rings are expensive to manufacture. Moreover, a slip ring according to the disclosure can be manufactured generally using the same processes used to manufacture typical c-ring slip rings (with the exception of the process used to form the slot), which is much less expensive. Accordingly, the slip ring of the present disclosure could be used as a direct replacement for existing c-ring slip rings with a slot of all sizes and weight ranges, and thus may be readily used in certain low-cost commodity packers.

[0019] FIG. 1 illustrates a well system 100 designed, manufactured, and operated according to one or more embodiments of the disclosure, the well system 100 including a sealing tool 150 including a sealing assembly 155 designed, manufactured and operated according to one or more embodiments of the disclosure. The well system 100 includes a wellbore 110 that extends from a terranean surface 120 into one or more subterranean zones 130. When completed, the well system 100 produces reservoir fluids and/or injects fluids into the subterranean zones 130. As those skilled in the art appreciate, the wellbore 120 may be fully cased, partially cased, or an open hole wellbore. In the illustrated embodiment of FIG. 1, the wellbore 110 is at least partially cased, and thus is lined with casing or liner 140. The casing or liner 140, as is depicted, may be held into place within the wellbore 110 by cement 145.

[0020] An example well sealing tool 150 is coupled with a tubing string 160 that extends from a wellhead 170 into the wellbore 110. The tubing string 160 can be a coiled tubing and/or a string of joint tubing coupled end to end. For example, the tubing string 160 may be a working string, an injection string, and/or a production string. The sealing tool 150 can include a bridge plug, frac plug, packer and/or other sealing tool, having a seal assembly 155 for sealing against the wellbore 110 wall (e.g., the casing 140, a liner and/or the bare rock in an open hole context). The seal assembly 155 can isolate an interval of the wellbore 110 above the seal assembly 155 from an interval of the wellbore 110 below the seal assembly 155, for example, so that a pressure differential can exist between the intervals.

[0021] In accordance with the disclosure, the seal assembly 155 may comprise a slip ring including a ring member having a first end, a second opposing end, a width (w), and a wall thickness (t). The slip ring, in at least one embodiment, further includes a slot located entirely through the wall thickness (t) and extending between the first end and the second opposing end, the slot configured to allow the ring member to move between a radially reduced state and a radially enlarged state. The slip ring, in yet another embodiment, is configured such that a first portion of the slot located at the first end and a second portion of the slot located at the second opposing end are radially offset from one another by at least 15-degrees.

[0022] Turning to FIGs. 2A through 2D, illustrated are different views of one embodiment of a slip ring 200 designed, manufactured, and operated according to one embodiment of the disclosure. FIG. 2A illustrates a first side view of the slip ring 200, FIG. 2B illustrates a first cross-sectional view of the slip ring 200 taken through the line 2B-2B of FIG. 2A, FIG. 2C illustrates a second side view of the slip ring 200 (e.g., rotated by about 180-degrees as related to the first side view of FIG. 2A), and FIG. 2D illustrates a second cross-sectional view of the slip ring 200 taken through the line 2D-2D of FIG. 2C. The slip ring 200, in the illustrated embodiment, includes a ring member 210 having a width (w), a wall thickness (t), an inside diameter (d_i) and an outside diameter (d_o). In at least one embodiment, the width (w) is no greater than 2.75 meters (e.g., about 9 feet). In at least one other embodiment, the width (w) is no greater than 1.83 meters (e.g., about 6 feet). In yet at least another embodiment, the width (w) ranges from .3 meters (e.g., about 1 foot) to 1.2 meters (e.g., about 4 feet). In at least one embodiment, the thickness (t) is no greater than 15 centimeters (e.g., about 5.9 inches). In at least one other embodiment, the thickness (t) is no greater than 9 centimeters (e.g., about 3.5 inches). In yet at least another embodiment, the thickness (t) ranges from 15 centimeters (e.g., about 5.9 inches) to 6 centimeters (e.g., about 2.4 inches).

[0023] The slip ring 200, in the illustrated embodiment, includes a first end 220 and a second opposing end 225. In at least one embodiment, the first end 220 is a first uphole end, and the second opposing end 225 is a second downhole end. Nevertheless, the opposite could be true, and in fact certain embodiments employ two slip rings 200 that would be oppositely arranged. In the embodiment of FIGs. 2A through 2D, the slip ring 200 additionally includes a plurality of teeth 230 extending from the ring member 210. In at least one embodiment, the plurality of teeth 230 are configured to grip a bore (e.g., tubular) located outside of the ring member 210 when the

ring member 210 is in a radially enlarged state. While a plurality of teeth 230 are illustrated in FIGs. 2A through 2D, other embodiments may employ different shaped protrusions.

[0024] In the embodiment of FIGs. 2A through 2D, the slip ring 200 additionally includes one or more reduced thickness notched 240 located in the ring member 210. The one or more reduced thickness notches 240 are configured to allow the ring member 210 to more easily flex between a radially reduced state and a radially enlarged state. The embodiment of FIGs. 2A through 2D illustrate the ring member 210 having four reduced thickness notches 240, for example radially offset from each other by 90-degrees. Nevertheless, the number and orientation of the reduced thickness notches 240 may vary while still remaining within the scope of the disclosure. Moreover, certain embodiments may exist wherein the ring member 210 does not include any reduced thickness notches 240.

[0025] The slip ring 200 of FIGs. 2A through 2D additionally includes a slot 250 located entirely through the wall thickness (t) and extending between the first end 220 and the second opposing end 225. In at least this embodiment, the slot 250 is configured to allow the ring member 210 to move between the radially reduced state (e.g., as shown) and the radially enlarged state (e.g., not shown). In accordance with one or more embodiments, a first portion of the slot 250 located at the first end 220 and a second portion of the slot 250 located at the second opposing end are radially offset from one another by at least 15-degrees. In accordance with one or more embodiments, the first portion of the slot 250 located at the first end 220 and the second portion of the slot 250 located at the second opposing end are radially offset from one another by at least 30-degrees. In accordance with one or more embodiments, the first portion of the slot 250 located at the first end 220 and the second portion of the slot 250 located at the second opposing end are radially offset from one another by at least 45-degrees. In accordance with another embodiment, the first portion of the slot 250 located at the first end 220 and the second portion of the slot 250 located at the second opposing end are radially offset from one another by at least 90-degrees. In accordance with yet another embodiment, the first portion of the slot 250 located at the first end 220 and the second portion of the slot 250 located at the second opposing end are radially offset from one another by at least 180-degrees (e.g., such as shown in FIG.s 2A through 2D), and in yet another embodiment radially offset from one another by at least 360-degrees. In even yet another embodiment, the slot 250 makes more than one full revolution around the ring

member 210, and thus is radially offset from one another by substantially more than 360-degrees (e.g., if the slot 250 were spiral shaped or helically shaped).

[0026] The slot 250 may take on many different shapes while achieving the aforementioned radial offset. In at least one embodiment, such as shown, the slot 250 is a non-linear slot. However, in other embodiments, the slot 250 is a liner slot. In the embodiment of FIGs. 2A through 2D, the slot 250 is a non-linear Z-shaped slot. For example, the slot 250 of FIGs. 2A through 2D includes a first portion extending from the first side 220 in a direction substantially parallel with the centerline (C_L), a second portion extending in a direction not substantially parallel with the centerline (C_L) (e.g., substantially perpendicular with the centerline (C_L)), and a third portion extending from the second portion in a direction substantially parallel with the centerline (C_L) and toward the second opposing side 225. Accordingly, the slot 250 forms a (e.g., modified) Z-shaped slot. The second portion of the slot 250 is illustrated at approximately a center point of the width (w) of the ring member 210, but such is not required. While the slot 250 is illustrated is a Z-shaped slot, as will be illustrated below, other shaped slots are within the scope of the disclosure.

[0027] Turning to FIGs. 3A through 3D, illustrated is an alternative embodiment of a slip ring 300 designed, manufactured, and operated according to an alternative embodiment of the disclosure. The slip ring 300 is similar in certain respects to the slip ring 200. Accordingly, like reference identifiers have been used to indicate similar, if not identical, features. The slip ring 300 differs, for the most part, from the slip ring 200, in that the slip ring 300 employs an S-shaped slot 350 (e.g., with a 180-degree radial offset).

[0028] Turning to FIGs. 4A through 4D, illustrated is an alternative embodiment of a slip ring 400 designed, manufactured and operated according to an alternative embodiment of the disclosure. The slip ring 400 is similar in certain respects to the slip ring 200. Accordingly, like reference identifiers have been used to indicate similar, if not identical, features. The slip ring 400 differs, for the most part, from the slip ring 200, in that the slip ring 400 employs a linear slot 450. The linear slot 450, in the illustrated embodiment, is situated such that the first portion of the slot 450 located at the first end 220 and the second portion of the slot 450 located at the second opposing end 225 are radially offset from one another by 180-degrees.

[0029] Turning to FIGs. 5A through 5D, illustrated is an alternative embodiment of a slip ring 500 designed, manufactured and operated according to an alternative embodiment of the

disclosure. The slip ring 500 is similar in certain respects to the slip ring 400. Accordingly, like reference identifiers have been used to indicate similar, if not identical, features. The slip ring 500 differs, for the most part, from the slip ring 400, in that the slip ring 500 is situated such that the first portion of the slot 550 located at the first end 220 and the second portion of the slot 550 located at the second opposing end 225 are radially offset from one another by 180-degrees.

[0030] Turning to FIGs. 6A through 6D, illustrated is an alternative embodiment of a slip ring 600 designed, manufactured and operated according to an alternative embodiment of the disclosure. The slip ring 600 is similar in certain respects to the slip ring 400. Accordingly, like reference identifiers have been used to indicate similar, if not identical, features. The slip ring 600 differs, for the most part, from the slip ring 400, in that the slip ring 600 is situated such that the first portion of the slot 650 located at the first end 220 and the second portion of the slot 650 located at the second opposing end 225 are radially offset from one another by 90-degrees.

[0031] Turning now to FIGs. 7A and 7B, illustrated are various different deployment states for a sealing tool 700 designed, manufactured and operated according to one aspect of the disclosure. FIG. 7A illustrates the sealing tool 700 in a run-in-hole state, and thus its slip ring is in the radially reduced state. In contrast, FIG. 7B illustrates the sealing tool 700 with its slip ring in the radially enlarged state. In the illustrated embodiment of FIGs. 7A and 7B, the sealing tool 700 is positioned within a bore 790. The bore 790, in at least one embodiment, is exposed wellbore. The bore 790, in at least one other embodiment, is a tubular positioned within a wellbore, such as a casing, production tubing, etc. In accordance with one aspect of the disclosure, the sealing tool 700 and the bore 790 form an annulus 780.

[0032] The sealing tool 700, in the illustrated embodiment of FIGs. 7A and 7B includes a mandrel (e.g., not shown as a result of being covered by the other features of the sealing tool 700). The mandrel, in the illustrated embodiment, is centered about a centerline (C_L). The sealing tool 700, in at least the embodiment of FIGs. 7A and 7B, additionally includes a sealing assembly 720 positioned about the mandrel. In at least one embodiment, the sealing assembly 720 includes first and second slip rings 730, 735 designed, manufactured and operated according to one or more embodiments of the disclosure. The first and second slip rings 730, 735, as discussed above, may each include a slot 740 located entirely through the wall thickness (t) and extending between the first end and the second opposing end thereof, and be configured such that a first portion of the slot 740 located at the first end and a second portion of the slot 740 located

at the second opposing end are radially offset from one another by at least 15-degrees. The slot 740 is visible in the first slip ring 730, but is not visible in the second slip ring 735. In at least one embodiment, such as shown, the slot 740 of the first slip ring 730 and the slot 740 of the second slip ring 735 are radially offset by an equal distance around the mandrel.

[0033] The sealing assembly 720, may additionally include one or more sealing elements 750 positioned about the mandrel, the one or more sealing elements 750 operable to move between a radially relaxed state and a radially expanded state. The one or more sealing elements 750, in the illustrated embodiment, are positioned between the first and second slip rings 730, 735. In at least one embodiment, the one or more sealing elements 750 are elastomeric sealing elements. In at least one other embodiment, the one or more sealing elements 750 are one or more swellable sealing elements.

[0034] The sealing assembly 720, in the illustrated embodiment, additionally includes one or more associated wedges 760. The one or more associated wedges 760, in the illustrated embodiment, include one or more associated angled surfaces that are operable to engage with the inside diameter (d_i) of the first and second slip rings 730, 735. Accordingly, the one or more associated wedges 760 may be used to move the first and second slip rings 730, 735 between the radially reduced state (e.g., as shown in FIG. 7A) and a radially enlarged state (e.g., as shown in FIG. 7B). In certain embodiment, the one or more associated wedges 760 also move the one or more sealing elements 750 between the radially relaxed state (e.g., as shown in FIG. 7A) and a radially expanded state (e.g., as shown in FIG. 7B).

[0035] The seal assembly 720, in one or more embodiments, additionally includes a piston structure 770 for axially moving the first and second slip rings 730, 735, one or more sealing elements 750, and one or more associated wedges 760 relative to one another. Accordingly, the piston structure 770 may be used to move the first and second slip rings 730, 735 between the radially reduced state (e.g., as shown in FIG. 7A) and a radially enlarged state (e.g., as shown in FIG. 7B). The piston structure 770 may take on many different designs while remaining within the scope of the present disclosure.

[0036] Aspects disclosed herein include:

A. A slip ring for use with a sealing assembly, the slip ring including: 1) a ring member having a first end, a second opposing end, a width (w), and a wall thickness (t); and 2) a slot

located entirely through the wall thickness (t) and extending between the first end and the second opposing end, the slot configured to allow the ring member to move between a radially reduced state and a radially enlarged state, and further wherein a first portion of the slot located at the first end and a second portion of the slot located at the second opposing end are radially offset from one another by at least 15-degrees.

B. A sealing tool, the sealing tool including: 1) a mandrel; and 2) a sealing assembly positioned about the mandrel, the sealing assembly having a slip ring including: a) a ring member having a first end, a second opposing end, a width (w), and a wall thickness (t); and b) a slot located entirely through the wall thickness (t) and extending between the first end and the second opposing end, the slot configured to allow the ring member to move between a radially reduced state and a radially enlarged state, and further wherein a first portion of the slot located at the first end and a second portion of the slot located at the second opposing end are radially offset from one another by at least 15-degrees.

C. A method for sealing an annulus within a wellbore, the method including: 1) providing a sealing tool within a wellbore, the sealing tool including: a) a mandrel; and b) a sealing assembly positioned about the mandrel, the sealing assembly having a slip ring including: i) a ring member having a first end, a second opposing end, a width (w), and a wall thickness (t); and ii) a slot located entirely through the wall thickness (t) and extending between the first end and the second opposing end, the slot configured to allow the ring member to move between a radially reduced state and a radially enlarged state, and further wherein a first portion of the slot located at the first end and a second portion of the slot located at the second opposing end are radially offset from one another by at least 15-degrees; and 2) setting the slip ring by moving the expandable metal ring member from the radially reduced state to the radially enlarged state engaged with a tubular in the wellbore.

[0037] Aspects A, B, and C may have one or more of the following additional elements in combination: Element 1: wherein the first portion of the slot located at the first end and the second portion of the slot located at the second opposing end are radially offset from one another by at least 360-degrees. Element 2: wherein the first portion of the slot located at the first end and the second portion of the slot located at the second opposing end are radially offset from one

another by at least 180-degrees. Element 3: wherein the first portion of the slot located at the first end and the second portion of the slot located at the second opposing end are radially offset from one another by at least 90-degrees. Element 4: wherein the slot is a non-linear slot. Element 5: wherein the slot is a Z-shaped slot. Element 6: wherein the slot is an S-shaped slot. Element 7: wherein the slot is a linear slot. Element 8: further including one or more reduced thickness notched located in the ring member, the one or more reduced thickness notches configured to allow the ring member to flex between the radially reduced state and the radially enlarged state. Element 9: further including a plurality of teeth extending from the ring member, the plurality of teeth configured to grip a tubular located outside of the ring member when the ring member is in the radially enlarged state. Element 10: wherein the sealing assembly further includes one or more sealing elements positioned about the mandrel, the one or more sealing elements operable to move between a radially relaxed state and a radially expanded state. Element 11: wherein the one or more sealing elements are one or more elastomeric sealing elements. Element 12: wherein the sealing assembly further includes one or more wedges positioned about the mandrel, the one or more wedges operable to move the ring member between the radially reduced state and the radially enlarged state. Element 13: further including one or more reduced thickness notched located in the ring member, the one or more reduced thickness notches configured to allow the ring member to flex between the radially reduced state and the radially enlarged state, and a plurality of teeth extending from the ring member, the plurality of teeth configured to grip a tubular located outside of the ring member when the ring member is in the radially enlarged state. Element 14: wherein the slip ring in the radially enlarged state has 360-degree contact with the tubular.

[0038] Those skilled in the art to which this application relates will appreciate that other and further additions, deletions, substitutions, and modifications may be made to the described embodiments.

WHAT IS CLAIMED IS:

1. A slip ring for use with a sealing assembly, comprising:
a ring member having a first end, a second opposing end, a width (w), and a wall thickness (t); and
a slot located entirely through the wall thickness (t) and extending between the first end and the second opposing end, the slot configured to allow the ring member to move between a radially reduced state and a radially enlarged state, and further wherein a first portion of the slot located at the first end and a second portion of the slot located at the second opposing end are radially offset from one another by at least 15-degrees.
2. The slip ring as recited in Claim 1, wherein the first portion of the slot located at the first end and the second portion of the slot located at the second opposing end are radially offset from one another by at least 360-degrees.
3. The slip ring as recited in Claim 1, wherein the first portion of the slot located at the first end and the second portion of the slot located at the second opposing end are radially offset from one another by at least 180-degrees.
4. The slip ring as recited in Claim 1, wherein the first portion of the slot located at the first end and the second portion of the slot located at the second opposing end are radially offset from one another by at least 90-degrees.
5. The slip ring as recited in Claim 1, wherein the slot is a non-linear slot.
6. The slip ring as recited in Claim 5, wherein the slot is a Z-shaped slot.
7. The slip ring as recited in Claim 5, wherein the slot is an S-shaped slot.
8. The slip ring as recited in Claim 1, wherein the slot is a linear slot.

9. The slip ring as recited in Claim 1, further including one or more reduced thickness notched located in the ring member, the one or more reduced thickness notches configured to allow the ring member to flex between the radially reduced state and the radially enlarged state.

10. The slip ring as recited in Claim 1, further including a plurality of teeth extending from the ring member, the plurality of teeth configured to grip a tubular located outside of the ring member when the ring member is in the radially enlarged state.

11. A sealing tool, comprising:
a mandrel; and
a sealing assembly positioned about the mandrel, the sealing assembly having a slip ring including:

a ring member having a first end, a second opposing end, a width (w), and a wall thickness (t); and

a slot located entirely through the wall thickness (t) and extending between the first end and the second opposing end, the slot configured to allow the ring member to move between a radially reduced state and a radially enlarged state, and further wherein a first portion of the slot located at the first end and a second portion of the slot located at the second opposing end are radially offset from one another by at least 15-degrees.

12. The sealing tool as recited in Claim 11, wherein the sealing assembly further includes one or more sealing elements positioned about the mandrel, the one or more sealing elements operable to move between a radially relaxed state and a radially expanded state.

13. The sealing tool as recited in Claim 12, wherein the one or more sealing elements are one or more elastomeric sealing elements.

14. The sealing tool as recited in Claim 11, wherein the sealing assembly further includes one or more wedges positioned about the mandrel, the one or more wedges operable to move the ring member between the radially reduced state and the radially enlarged state.

15. The sealing tool as recited in Claim 11, wherein the first portion of the slot located at the first end and the second portion of the slot located at the second opposing end are radially offset from one another by at least 90-degrees.

16. The sealing tool as recited in Claim 11, wherein the slot is a non-linear slot.

17. The sealing tool as recited in Claim 16, wherein the slot is a Z-shaped slot or an S-shaped slot.

18. The sealing tool as recited in Claim 11, wherein the slot is a linear slot.

19. The sealing tool as recited in Claim 11, further including one or more reduced thickness notched located in the ring member, the one or more reduced thickness notches configured to allow the ring member to flex between the radially reduced state and the radially enlarged state, and a plurality of teeth extending from the ring member, the plurality of teeth configured to grip a tubular located outside of the ring member when the ring member is in the radially enlarged state.

20. A method for sealing an annulus within a wellbore, comprising:

providing a sealing tool within a wellbore, the sealing tool including:

a mandrel; and

a sealing assembly positioned about the mandrel, the sealing assembly having a slip ring including:

a ring member having a first end, a second opposing end, a width (w), and a wall thickness (t); and

a slot located entirely through the wall thickness (t) and extending between the first end and the second opposing end, the slot configured to allow the ring member to move between a radially reduced state and a radially enlarged state, and further wherein a first portion of the slot located at the first end and a second portion of the slot located at the second opposing end are radially offset from one another by at least 15-degrees; and

setting the slip ring by moving the expandable metal ring member from the radially reduced state to the radially enlarged state engaged with a tubular in the wellbore.

21. The method as recited in Claim 20, wherein the slip ring in the radially enlarged state has 360-degree contact with the tubular.