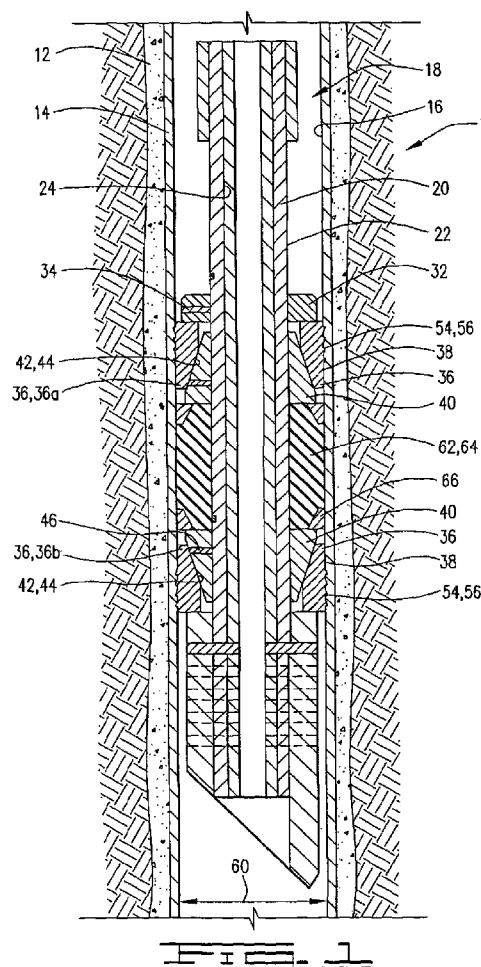




- (51) International Patent Classification: Not classified
- (21) International Application Number: PCT/GB2012/000317
- (22) International Filing Date: 5 April 2012 (05.04.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 13/080,536 5 April 2011 (05.04.2011) US
- (71) Applicant (for all designated States except US): **HAL-LIBURTON ENERGY SERVICES, INC.** [US/US]; 10200 Bellaire Boulevard, Houston, Texas 77072 (US).
- (71) Applicant (for MW only): **COTTRILL, Emily Elizabeth Helen** [GB/GB]; A A Thornton & Co, 235 High Holborn, London WC1V 7LE (GB).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): **STANDRIDGE, William Ellis** [US/US]; Route 1 Box 214, Madill, Oklahoma 73446 (US).
- (74) Agents: **COTTRILL, Emily Elizabeth Helen** et al.; A A Thornton & Co, 235 High Holborn, London WC1V 7LE (GB).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,

[Continued on next page]

(54) Title: DRILLABLE SLIP WITH NON-CONTINUOUS OUTER DIAMETER



(57) Abstract: A slip for use in the anchoring of a downhole tool in a well casing is provided. The slip's outer diameter is about equal to the inner diameter of the well casing. The slip is positioned about a mandrel and radially expands upon the application of force. The wickers on the slip deformably engage the casing in response to a force.





HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,

Published:

— *without international search report and to be republished upon receipt of that report (Rule 48.2(g))*

DRILLABLE SLIP WITH NON-CONTINUOUS OUTER DIAMETER**BACKGROUND**

[0001] This invention relates generally to downhole tools for use in oil and gas wellbores, and methods of anchoring such apparatuses within the casing of the wellbore. This invention particularly relates to improving the engagement of slip elements within a casing or tubing. These slip elements are commonly used in setting or anchoring of a downhole drillable packer, bridge plug and frac plug tools.

[0002] In drilling or reworking oil wells, many varieties of downhole tools are used. For example, but not by way of limitation, it is often desirable to seal tubing or other pipe in the casing of the well by pumping cement or other slurry down the tubing, and forcing the slurry around the annulus of the tubing or out into a formation. It then becomes necessary to seal the tubing with respect to the well casing and to prevent the fluid pressure of the slurry from lifting the tubing out of the well, or for otherwise isolating specific zones in a well. Downhole tools referred to as packers, bridge plugs and frac plugs are designed for these general purposes, and are well known in the art of producing oil and gas.

[0003] Both packers and bridge plugs are used to isolate the portion of the well below the packer or bridge plug from the portion of the well thereabove. Accordingly, packers and bridge plugs may experience a high differential pressure, and must be capable of withstanding the pressure so that the packer or bridge plug seals the well, and does not move in the well after being set.

[0004] Packers and bridge plugs used with a downhole tool both make use of metallic or non-metallic slip assemblies, or slips, that are initially retained in close proximity to a mandrel. These packers and bridge plugs are forced outwardly away from the mandrel upon the downhole tool being set to engage a casing previously installed within an open wellbore. Upon positioning the downhole tool at the desired depth, or position, a setting tool or other means of exerting force, or loading, upon the downhole tool forces the slips to fracture and expand radially outward against the inside of the casing. This action anchors the packer, or bridge plug, so that the downhole tool will not move relative to the casing.

[0005] To prevent slipping of the downhole tool, slip rings with wickers are used to set the downhole tool and engage the well casing. The wickers cut into and deform the inner casing wall. Unfortunately, the outer diameter of the slip rings and wickers is notably

smaller than the inner diameter of the casing. Thus, the wickers only partially and unevenly engage the casing wall, thereby allowing the downhole tool to slide within the well.

SUMMARY

[0006] In a first aspect, the present invention provide an apparatus for use in a well, the apparatus for anchoring a downhole tool against a casing disposed in the well, the apparatus comprising: a mandrel; a slip assembly positioned on the mandrel, the slip assembly having at least one slip ring; and a plurality of slip banks integrally formed on the slip ring wherein the slip ring has at least one circumferential pair of slip banks, the slip banks having a groove longitudinally positioned between each circumferential pair of slip banks, wherein the slip ring has an outer diameter about equal to the inner diameter of the casing.

[0007] Each of the slip banks of the apparatus may have a plurality of wickers formed therewith. Each of the plurality of wickers may have a cutting edge defined thereon and extending radially outward from the slip ring. Each of the grooves may define a fracture channel. The slip ring may be a unitary slip ring. The unitary slip ring may be formed from a drillable material. The outer diameter of the slip ring may be between about 1/16th of an inch (0.159 centimeters) less than the inner diameter of the casing and about equal to the inner diameter of the casing.

[0008] In a second aspect, the present invention provides a unitary downhole anchor for use in a well having a casing positioned therein, the casing having an inner diameter, the unitary downhole anchor comprising: a mandrel; a slip assembly positioned on the mandrel, the slip assembly having at least one outwardly expandable slip ring, the slip ring being a unitary slip ring, and at least one slip wedge, wherein the slip wedge and slip ring are movable relative to one another when force is applied to the slip assembly, whereby the slip ring will expand radially outward in response to such movement; and a plurality of slip banks circumferentially defined on the slip ring, wherein the slip ring has at least one circumferential pair of slip banks, the slip banks having a groove longitudinally positioned between each circumferential pair of slip banks, wherein the slip ring has an outer diameter about equal to the nominal inner diameter.

[0009] The unitary downhole anchor may further comprise a plurality of wickers defined on the slip bank. The plurality of wickers may deformably engage the casing upon the

application of a force to the slip assembly. The groove may be a fracture channel. Each of the plurality of wickers may be integrally formed from the slip ring.

[0010] In a third aspect, the present invention provides an evenly setting anchor apparatus for anchoring a downhole tool in a well, the well having a casing secured therein, the apparatus comprising: a mandrel; at least one slip assembly positioned on the mandrel, the slip assembly having at least one slip ring and at least one slip wedge, wherein each slip ring has a plurality of radially expandable slip banks; a plurality of wickers defined on each of the slip banks, wherein each the wicker has a cutting edge extending therefrom, wherein the wickers are positioned to evenly set against an inner wall of the casing wall in response to an input force.

[0011] The casing may have an inner diameter and the slip ring has an outer diameter that is about equal to the inner diameter. The casing may have an inner diameter and the slip ring has an outer diameter that is equal to the inner diameter. The slip ring may be a unitary slip ring. The slip banks may further comprise at least one circumferential pair of slip banks having a groove longitudinally positioned therebetween. The groove may define a fracture channel. Each of the wickers may evenly set against the casing inner wall thereby deformably engaging the casing inner wall.

[0012] In a fourth aspect, the present invention provides a downhole tool anchoring apparatus for use in high-pressure wells, the high-pressure well having a casing and the casing having an inner diameter, the anchoring apparatus comprising: a mandrel; a slip assembly positioned on the mandrel, the slip assembly having at least one slip ring; and a slip bank defined on the slip ring, wherein the slip bank has at least one wicker integrally formed therewith, the wicker being designed to engage and anchor the downhole tool within the casing in the high-pressure well.

[0013] The high-pressure well may have a pressure between about 8,000 pounds per square inch (about 55 megapascals) and about 12,000 pounds per square inch (about 83 megapascals). The slip ring may have an outer diameter about equal to the inner diameter of the casing. The outer diameter may be about 1/16 of an inch (0.159 centimeters) or less than the inner diameter. The slip ring may have an outer diameter equal to the inner diameter of the casing. The outer diameter may be 1/16 of an inch (0.159 centimeters) or less than the inner diameter. The wicker may have a cutting edge defined thereon and extends radially outward.

[0014] In a fifth aspect, the present invention provide an apparatus for use in a well, the apparatus for anchoring a downhole tool against a casing disposed in the well, the apparatus comprising: a mandrel; a slip assembly positioned on the mandrel, the slip assembly having at least one slip ring; and a plurality of slip banks integrally formed on the slip ring wherein the slip ring has at least one circumferential pair of slip banks, the slip banks having a groove longitudinally positioned between each circumferential pair of slip banks, wherein the slip ring has an outer diameter equal to the inner diameter of the casing.

[0015] Each of the slip banks of the apparatus may have a plurality of wickers formed therewith. Each of the plurality of wickers may have a cutting edge defined thereon and extending radially outward from the slip ring. Each of the grooves may define a fracture channel. The slip ring may be a unitary slip ring. The unitary slip ring may be formed from a drillable material. The outer diameter of the slip ring may be between 1/16th of an inch (0.159 centimeters) less than the inner diameter of the casing and equal to the inner diameter of the casing.

[0016] In a sixth aspect, the present invention provides a unitary downhole anchor for use in a well having a casing positioned therein, the casing having an inner diameter, the unitary downhole anchor comprising: a mandrel; a slip assembly positioned on the mandrel, the slip assembly having at least one outwardly expandable slip ring, the slip ring being a unitary slip ring, and at least one slip wedge, wherein the slip wedge and slip ring are movable relative to one another when force is applied to the slip assembly, whereby the slip ring will expand radially outward in response to such movement; and a plurality of slip banks circumferentially defined on the slip ring, wherein the slip ring has at least one circumferential pair of slip banks, the slip banks having a groove longitudinally positioned between each circumferential pair of slip banks, wherein the slip ring has an outer diameter equal to the nominal inner diameter.

[0017] The unitary downhole anchor may further comprise a plurality of wickers defined on the slip bank. The plurality of wickers may deformably engage the casing upon the application of a force to the slip assembly. The groove may be a fracture channel. Each of the plurality of wickers may be integrally formed from the slip ring.

[0018] In one embodiment, an apparatus for use in a well is provided. The apparatus is for anchoring a downhole tool against a casing disposed in the well. The apparatus comprises a mandrel and a slip assembly. The slip assembly is positioned on the mandrel.

The slip assembly has at least one slip ring. There are a plurality of slip banks formed on the slip ring. The slip banks have a groove longitudinally positioned between each circumferential pair of slip banks. The slip ring has an outer diameter about equal to the inner diameter of the casing.

[0019] In another embodiment, a unitary downhole anchor for use in a well having a casing positioned therein is provided. The casing has an inner diameter. The unitary downhole anchor comprises a mandrel and a slip assembly. The slip assembly is positioned on the mandrel. The slip assembly has at least one outwardly expandable slip ring and at least one slip wedge. The slip ring is a unitary slip ring. The slip wedge and slip ring are movable relative to one another when force is applied to the slip assembly, whereby the slip ring will expand radially outward in response to such movement. There are a plurality of slip banks circumferentially defined on the slip ring. The slip ring has at least one circumferential pair of slip banks. The slip banks have a groove longitudinally positioned between each circumferential pair of slip banks. The slip ring has an outer diameter about equal to the nominal inner diameter.

[0020] In yet another embodiment, an evenly setting anchor apparatus for anchoring a downhole tool in a well, the well having a casing secured therein, is provided. The apparatus comprises a mandrel and at least one slip assembly that is positioned on the mandrel. The slip assembly has at least one slip ring and at least one slip wedge. Each slip ring has a plurality of radially expandable slip banks. There are a plurality of wickers defined on each of the slip banks. Each of the wickers has a cutting edge extending therefrom, wherein the wickers are positioned to evenly set against an inner wall of the casing in response to an input force.

[0021] In still another embodiment, a downhole tool anchoring apparatus for use in high-pressure wells is provided. The high-pressure well has a casing and the casing has an inner diameter. The apparatus comprises a mandrel and a slip assembly. The slip assembly is positioned on the mandrel. The slip assembly has at least one slip ring. The slip bank is defined on the slip ring. The slip bank has at least one wicker integrally formed therewith. The wicker is designed to engage and anchor the downhole tool within the casing in the high-pressure well.

BRIEF DESCRIPTION OF THE DRAWINGS

- [0022] FIG. 1 is a cross-section of a downhole tool disposed in a well with a slip assembly.
- [0023] FIG. 2 is a cross-section of an alternative downhole tool disposed in a well with a slip assembly.
- [0024] FIG. 3 is a bottom perspective view of the slip.
- [0025] FIG. 4 is a top perspective view of the slip.
- [0026] FIG. 5 is a bottom view of the slip.
- [0027] FIG. 6 is a cross-sectional view of the slip taken along section line 6-6 of FIG. 5.
- [0028] FIG. 7 is a detail view of a slip bank taken from FIG. 5.
- [0029] FIG. 8 is an alternative configuration of the slip from FIG. 3.
- [0030] FIG. 9 is a bottom perspective view of an alternative slip.
- [0031] FIG. 10 is a top perspective view of the alternative slip.

DETAILED DESCRIPTION

[0032] Referring to the drawings, FIG. 1 illustrates well 10 having wellbore 12 with casing 14 cemented therein. Casing 14 has inner wall 16. Downhole tool 18 includes mandrel 20 with an outer surface 22 and an inner surface 24.

[0033] By way of a non-limiting example, downhole tool 18 illustrated in FIG. 1 is referred to as a packer, and allows fluid communication therethrough. The packer illustrated may be used as a frac plug. In another non-limiting example, downhole tool 18 illustrated in FIG. 2 is referred to as bridge plug. For this second non-limiting example, downhole tool 18 has optional plug 26 pinned within mandrel 20 by radially oriented pins 28. Plug 26 has a seal 30 located between plug 26 and mandrel 20. Without plug 26, downhole tool 18 is suited for use as, and referred to as a packer.

[0034] As illustrated in FIGS. 1 and 2, spacer ring 32 is mounted to mandrel 20 with a pin 34. Slip assembly 36 is positioned on and/or disposed about mandrel 20. Spacer ring 32 provides an abutment, which serves to axially retain slip assembly 36. As illustrated in FIGS. 1 and 2, downhole tool 18 has two slip assemblies 36, namely a first slip assembly and second slip assembly, depicted in FIGS. 1 and 2 as first and second slip assemblies 36a and 36b for ease of reference. Slip assemblies 36a and 36b provide anchoring for downhole tool 18 to casing 14 within well 10. The structure of slip assemblies 36a and 36b is

identical, and only the orientation and position on downhole tool 18 are different. As illustrated in FIG. 2, each slip assembly 36 includes at least one slip ring 38 and at least one slip wedge 40. Slip ring 38 has an inclined/wedge-shaped first surface 42 positioned proximate to an inclined/wedge-shaped complementary second surface 44 of slip wedge 40. Slip assembly 36 is depicted in FIG. 2 as being pinned into place with pins 46.

[0035] Slip ring 38, shown in FIGS. 3-8, is an expandable slip ring 38 and has a plurality of slip banks 48. Slip banks 48 are separated by groove 50, which is also fracture channel 52. Groove 50 and fracture channel 52 provide a weakened point in slip ring 38 for slip banks 48 to break apart from each other when sufficient forces are radially exerted on the interior of slip ring 38. Without limiting the invention, slip ring 38 may include a plurality of slip banks 48. Slip bank 48 has an outer arcuate edge 53. Collectively, all slip banks 48 make up a circumferential slip ring 38. Preferably, slip ring 38 has at least one circumferential pair of slip banks 48 with at least one groove 50 or fracture channel 52 positioned therebetween. As illustrated in FIGS. 3-8, slip ring 38 has eight slip banks 48. Also, as illustrated, slip ring 38 is a unitary slip ring without requiring the use of frangible retaining rings.

[0036] Preferably, each slip bank 48 defines at least one wicker 54 thereon. As illustrated, a plurality of wickers are defined on each slip bank 48. The number of wickers 54 on each slip bank 48 is determined by the size of casing 14 and the pressure slip ring 38 is designed to resist. The non-limiting example illustrated in FIGS. 3-7 shows each slip bank 48 having five wickers defined thereon. Wicker 54 has cutting edge 56 extending therefrom and oriented towards casing inner wall 16. Preferably, wickers 54 are integrally formed from slip ring 38. In the alternative, wickers 54 may be secured to slip ring 38, or inserted into slip ring 38 by other means known to those skilled in the art.

[0037] Wickers 54 are positioned on slip bank 48 such that each cutting edge 56 is able to be evenly set against casing inner wall 16. Thereby, each cutting edge is nearly equal in the force exerted upon casing inner wall 16. Thus, each cutting edge 56 is better able to penetrate and/or deformably cut into casing inner wall 16. This action securely anchors downhole tool 18.

[0038] Including wickers 54 and cutting edge 56, slip ring 38 has an outer diameter 58 that is about equal to inner diameter 60 of casing 14. A non-limiting example is illustrated in FIGS. 3-7, where the nominal casing 14 diameter is about 4.5 inches (11.43 centimeters)

and the nominal casing inner wall 16 has inner diameter 60 of about 4.04 inches (10.26 centimeters). Similarly, outer diameter 58 is also about between about 3.98 inches (10.1 centimeters) and about 4.04 inches (10.26 centimeters), or about 0.0625 inches (0.159 centimeters), which is about $1/16^{\text{th}}$ of an inch. For the purposes of this invention, outer diameter 58 of slip ring 38 is about equal to inner diameter 60 of casing 14. It will be appreciated by the skilled person that the term “about equal”, when used to describe the outer diameter of the slip ring and the inner diameter of the casing, may mean that the two diameters are “substantially the same” or “substantially equal”. It will also be appreciated that that the term “about equal” may mean that the outer diameter of the slip ring and the inner diameter of the casing are “equal”. In an embodiment, the outer diameter of the slip ring may be “about equal”, but less than “equal”, to the inner diameter of the casing. In another embodiment, the outer diameter of the slip ring may be in the range of 95% to less than or equal to 100% of the inner diameter of the casing; in the range of 96% to less than or equal to 100% of the inner diameter of the casing; in the range of 97% to less than or equal to 100% of the inner diameter of the casing; in the range of 98% to less than or equal to 100% of the inner diameter of the casing; in the range of 98.5% to less than or equal to 100% of the inner diameter of the casing; or in the range of 99% to less than or equal to 100% of the inner diameter of the casing.

[0039] Slip rings 38 are comprised of a drillable material and may be, for example, cast iron or a molded phenolic. Slip rings 38 may be made from other drillable materials such as drillable metals, composites and engineering grade plastics. The remainder of slip assembly 36 and other components of the tool may likewise be made from drillable materials.

[0040] Slip assemblies 36a and 36b are illustrated in FIGS. 1 and 2 as being separated by packer element assembly 62. As illustrated, packer element assembly 62 includes at least one expandable packer element 64, which is positioned between slip wedges 40. Packer shoes 66 may provide axial support to the ends of packer element assembly 62.

[0041] Referring to the example illustrated in FIGS. 3-10, slip bank 48 is a portion of a circle having slip bank 48 outer arcuate edge 68 measured between groove centerlines 70. Outer arcuate edge 68 has angle 72 between first slip bank edge 74 and second slip bank edge 76 of 180° or less. As illustrated in FIG. 5, angle 72 is about 45° .

[0042] Regarding FIG. 6, a section view of FIG. 5 is illustrated and provides exemplary angles and measurements for a slip ring 38 designed for use in a 4.5 inch (about 11.43

centimeters) outer diameter casing. In this example, outer diameter 78 of slip ring 38 is about 3.5 inches (8.89 centimeters) and height 80 of about 1.95 inches (4.95 centimeters). Slip ring 38 also has first end 82 and second end 84. First end 82 is adapted to receive slip wedge 40.

[0043] Slip ring 38 has true centerline 86 and offset centerline 88. Offset centerline 88 is the centerline for slip ring 38 after slip banks 48 have been fractured by slip wedge 40. As illustrated in FIG. 7, each slip bank 48 has outer arcuate edge 68 machined with radius 90. Radius 90 is measured from offset centerline 88, and for this example, radius 90 is about 2.02 inches. Radius 92 is the radius from the true centerline 86 to center 94 of cutting edge 56 on each slip bank 48 for the unfractured slip ring 38.

[0044] Regarding FIG. 8, an alternative embodiment of slip ring 38 illustrated in FIG. 3 is depicted. In the alternative version of slip ring 38, additional longitudinal channels 96 are defined on each cutting edge of each wicker 54. Longitudinal channels 96 provide for additional non-continuous wicker segments.

[0045] Another alternative embodiment of slip ring 38 is illustrated in FIGS. 9 and 10. In this alternative, slip ring 38 is designed for a 5.5 inch (13.97 centimeters) outer diameter casing. In this larger embodiment, an extra row of wickers is included to provide for additional holding power. Slip ring 38 illustrated in FIGS. 9 and 10 is an example that may be used on a high-pressure well. One non-limiting example of a high-pressure well has a pressure between about 8,000 pounds per square inch (about 55 megapascals) and about 12,000 pounds per square inch (about 83 megapascals). However, wells have pressures greater and lower, and slip rings 38 are also designed for use in other wells. Thus, as previously stated, the number of wickers 54 on each slip bank 48 is determined by the size of casing 14 and the pressure slip ring 38 is designed to resist.

[0046] In operation, downhole tool 18 is positioned at the desired depth or location by a setting tool, such as a wireline. The wireline exerts an initial or first force upon slip assembly 36, causing slip wedge 40 and slip ring 38 to move relative to one another, which radially exerts an internal radial force upon slip ring 38. Slip wedge 40 has inclined surface 42 defined thereon. Slip ring 38 radially expands outward as complementary second surface 44 slides against inclined first surface 42 of slip wedge 40. The sliding effect of complementary second surface 44 against inclined first surface 42 causes slip ring 38 to force cutting edge 56 of wickers 54 defined on slip bank 38 against casing inner wall 16. As

the radial force is increased, cutting edge 56 of wickers 54 penetrate into casing inner wall 16. This radial force is sufficient to penetrate the casing grade for the particular casing 14 utilized, thereby setting downhole tool 18.

[0047] Other embodiments of the current invention will be apparent to those skilled in the art from a consideration of this specification or practice of the invention disclosed herein. Thus, the foregoing specification is considered merely exemplary of the current invention with the true scope thereof being defined by the following claims.

CLAIMS:

1. An apparatus for use in a well, the apparatus for anchoring a downhole tool against a casing disposed in the well, the apparatus comprising:
 - a mandrel;
 - a slip assembly positioned on the mandrel, the slip assembly having at least one slip ring; and
 - a plurality of slip banks integrally formed on the slip ring wherein the slip ring has at least one circumferential pair of slip banks, the slip banks having a groove longitudinally positioned between each circumferential pair of slip banks, wherein the slip ring has an outer diameter about equal to the inner diameter of the casing.
2. An apparatus according to claim 1, wherein each of the slip banks have a plurality of wickers formed therewith.
3. An apparatus according to claim 2, wherein each of the plurality of wickers has a cutting edge defined thereon and extending radially outward from the slip ring.
4. An apparatus according to any preceding claim, wherein each of the grooves define a fracture channel.
5. An apparatus according to any preceding claim, wherein the slip ring is a unitary slip ring.
6. An apparatus according to claim 5, wherein the unitary slip ring is formed from a drillable material.
7. An apparatus according to any preceding claim, wherein the outer diameter of the slip ring is between about $1/16^{\text{th}}$ of an inch (0.159 centimeters) less than the inner diameter of the casing and about equal to the inner diameter of the casing.
8. A unitary downhole anchor for use in a well having a casing positioned therein, the casing having an inner diameter, the unitary downhole anchor comprising:
 - a mandrel;
 - a slip assembly positioned on the mandrel, the slip assembly having at least one outwardly expandable slip ring, the slip ring being a unitary slip ring, and at least one slip wedge, wherein the slip wedge and slip ring are movable relative to one another when force is applied to the slip assembly, whereby the slip ring will expand radially outward in response to such movement; and

a plurality of slip banks circumferentially defined on the slip ring, wherein the slip ring has at least one circumferential pair of slip banks, the slip banks having a groove longitudinally positioned between each circumferential pair of slip banks, wherein the slip ring has an outer diameter about equal to the nominal inner diameter.

9. A unitary downhole anchor according to claim 8, further comprising a plurality of wickers defined on the slip bank.

10. A unitary downhole anchor according to claim 9, wherein the plurality of wickers deformably engage the casing upon the application of a force to the slip assembly.

11. A unitary downhole anchor according to claim 8, 9 or 10, wherein the groove is a fracture channel.

12. A unitary downhole anchor according to claim 8, 9, 10 or 11, wherein each of the plurality of wickers is integrally formed from the slip ring.

13. An evenly setting anchor apparatus for anchoring a downhole tool in a well, the well having a casing secured therein, the apparatus comprising:

a mandrel;

at least one slip assembly positioned on the mandrel, the slip assembly having at least one slip ring and at least one slip wedge, wherein each slip ring has a plurality of radially expandable slip banks;

a plurality of wickers defined on each of the slip banks, wherein each the wicker has a cutting edge extending therefrom, wherein the wickers are positioned to evenly set against an inner wall of the casing wall in response to an input force.

14. An evenly setting anchor apparatus according to claim 13, wherein the casing has an inner diameter and the slip ring has an outer diameter that is about equal to the inner diameter.

15. An evenly setting anchor apparatus according to claim 13 or 14, wherein the slip ring is a unitary slip ring.

16. An evenly setting anchor apparatus according to of claim 13, 14 or 15, wherein the slip banks further comprise at least one circumferential pair of slip banks having a groove longitudinally positioned therebetween .

17. An evenly setting anchor apparatus according of claim 16, wherein the groove defines a fracture channel.

18. An evenly setting anchor apparatus according to any one of claims 13 to 17, wherein each of the wickers evenly set against the casing inner wall thereby deformably engaging the casing inner wall.

19. A downhole tool anchoring apparatus for use in high-pressure wells, the high-pressure well having a casing and the casing having an inner diameter, the anchoring apparatus comprising:

a mandrel;

a slip assembly positioned on the mandrel, the slip assembly having at least one slip ring; and

a slip bank defined on the slip ring, wherein the slip bank has at least one wicker integrally formed therewith, the wicker being designed to engage and anchor the downhole tool within the casing in the high-pressure well.

20. An anchoring apparatus according to claim 19, wherein the high-pressure well has a pressure between about 8,000 pounds per square inch (about 55 megapascals) and about 12,000 pounds per square inch (about 83 megapascals).

21. An anchoring apparatus according to claim 19 or 20 wherein the slip ring has an outer diameter about equal to the inner diameter of the casing.

22. An anchoring apparatus according to claim 21, wherein the outer diameter is about 1/16 of an inch (0.159 centimeters) or less than the inner diameter.

23. An apparatus according to claim 19, 20, 21 or 22, wherein the wicker has a cutting edge defined thereon and extends radially outward.

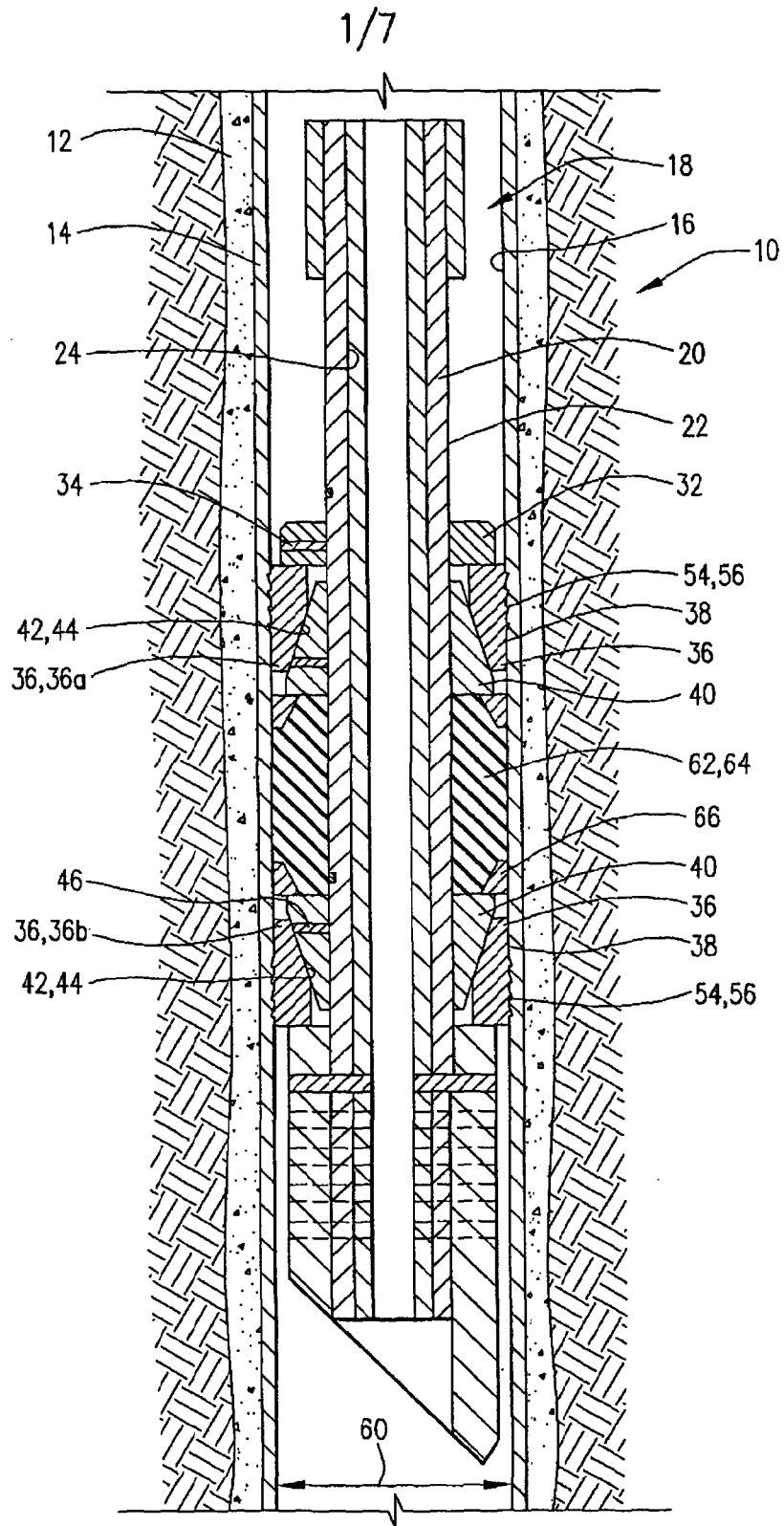
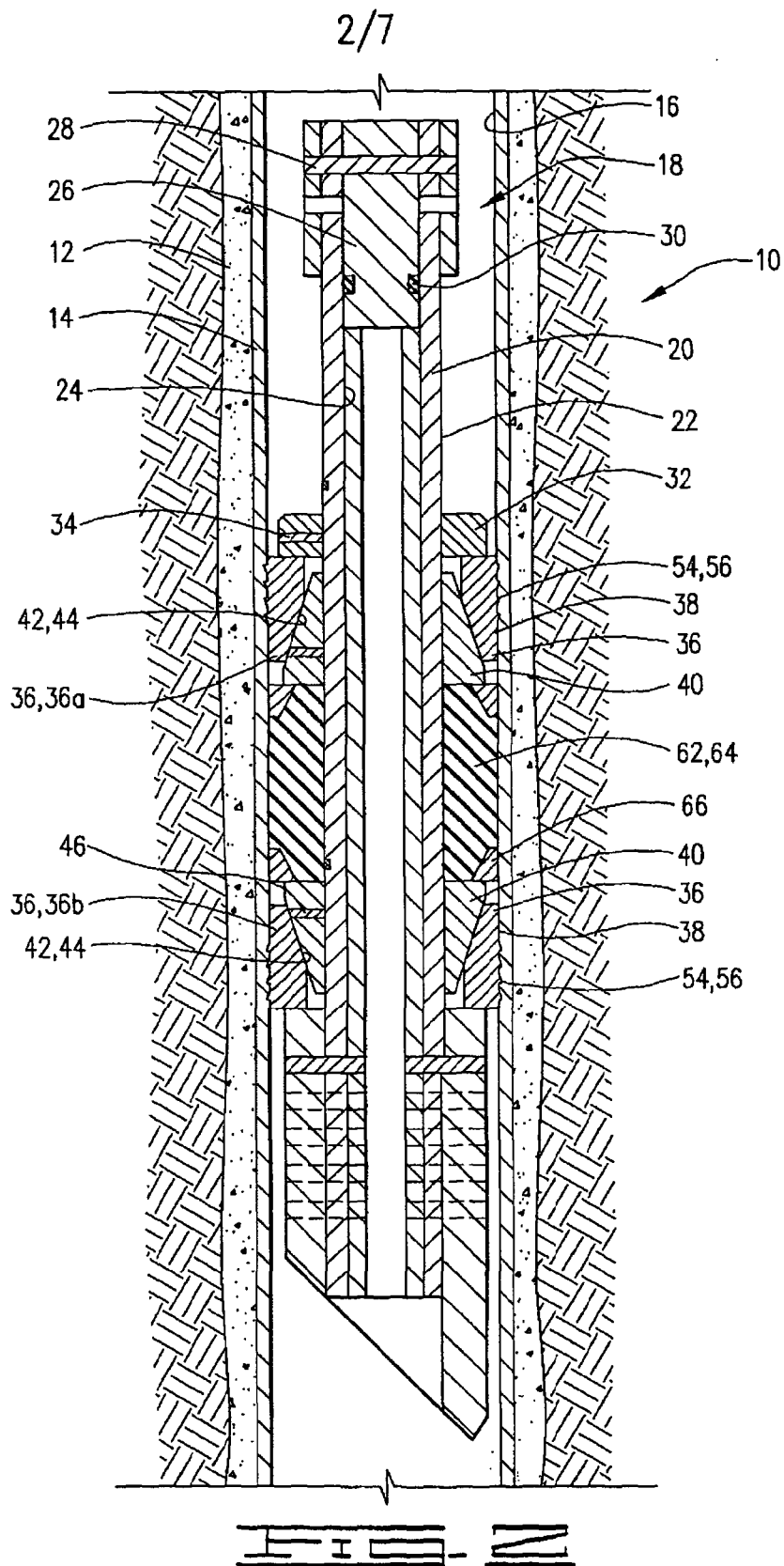


FIG. 1



+

3/7

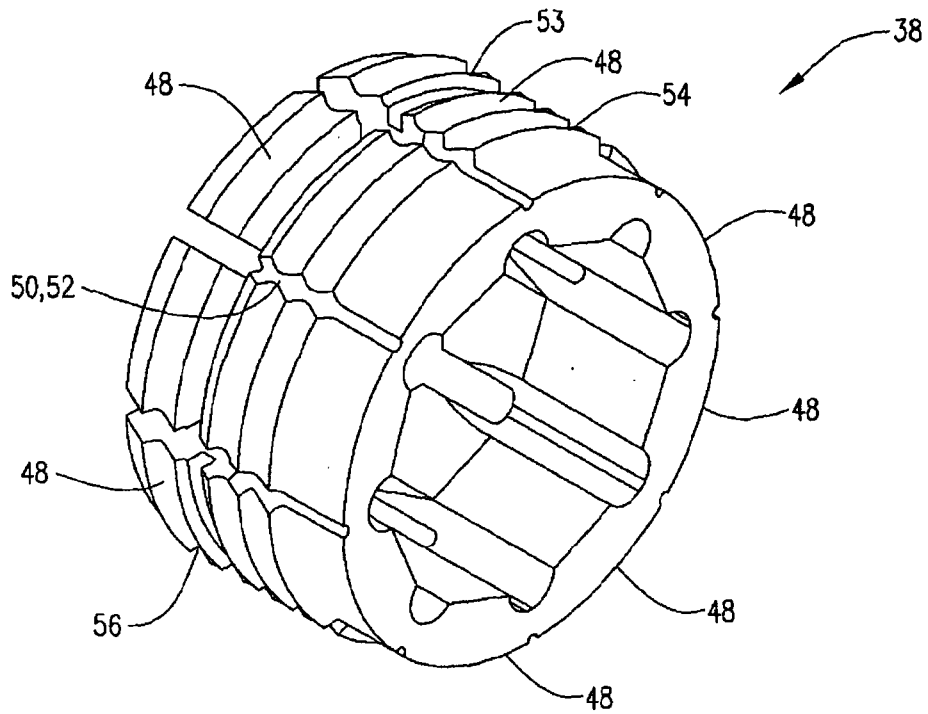


FIG. 3

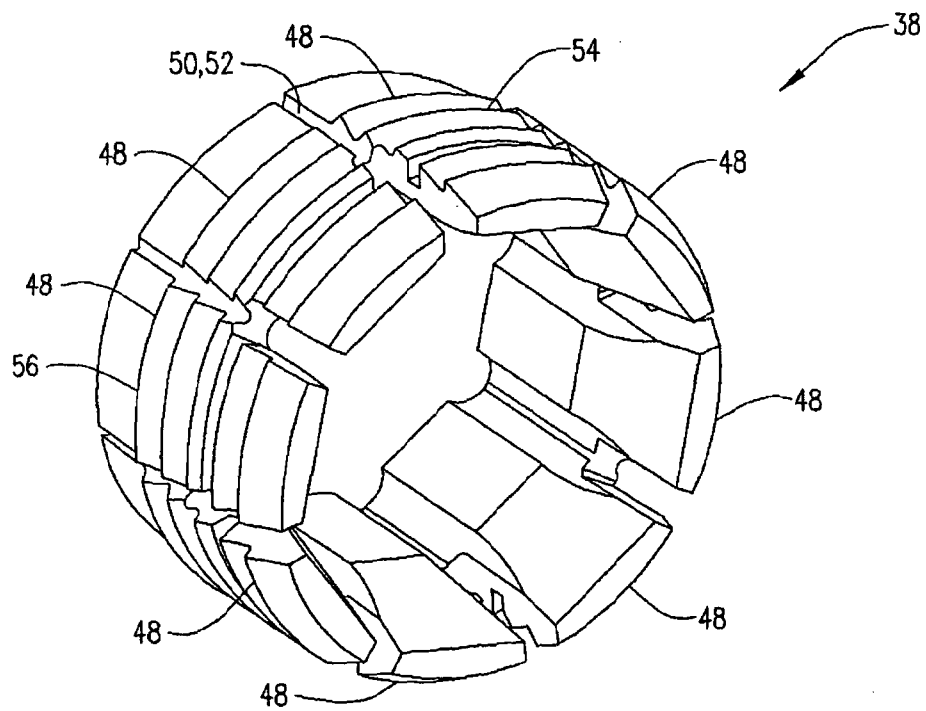


FIG. 4

+

+

5/7

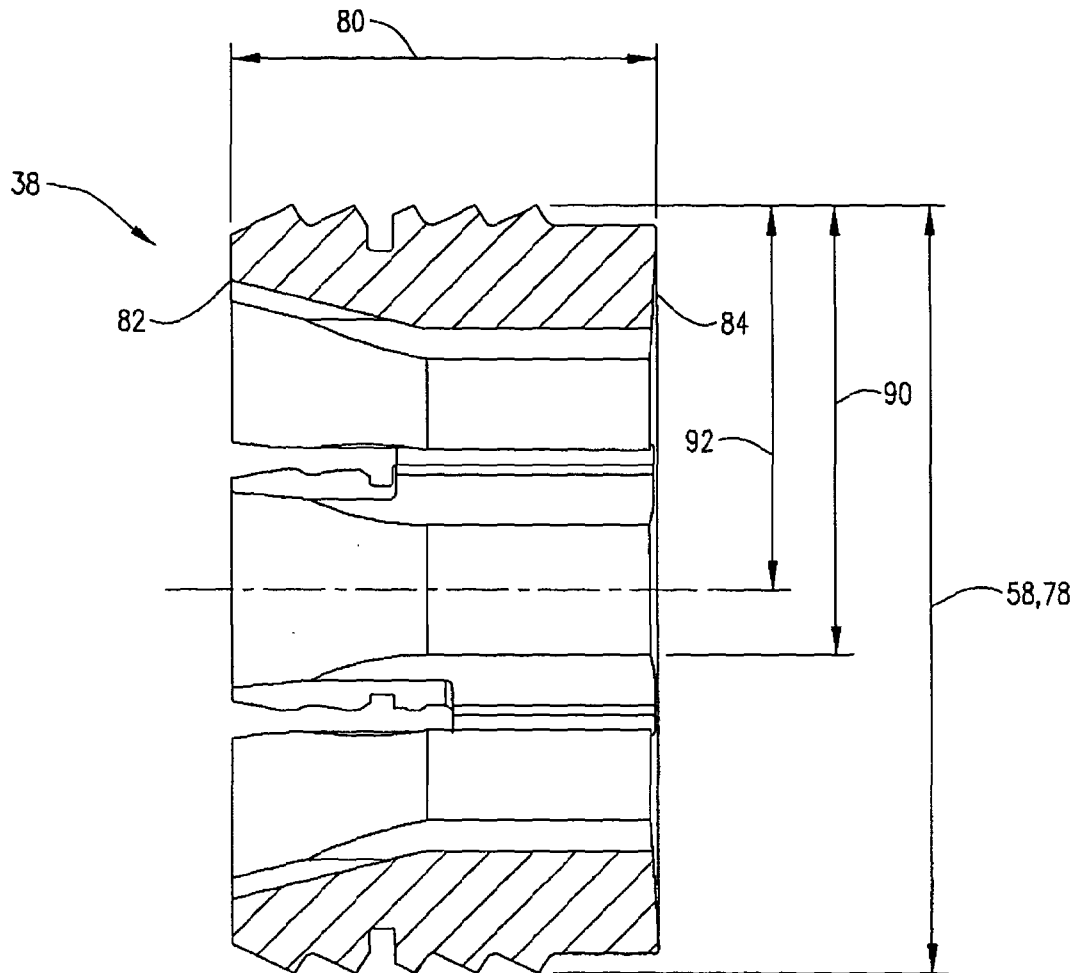
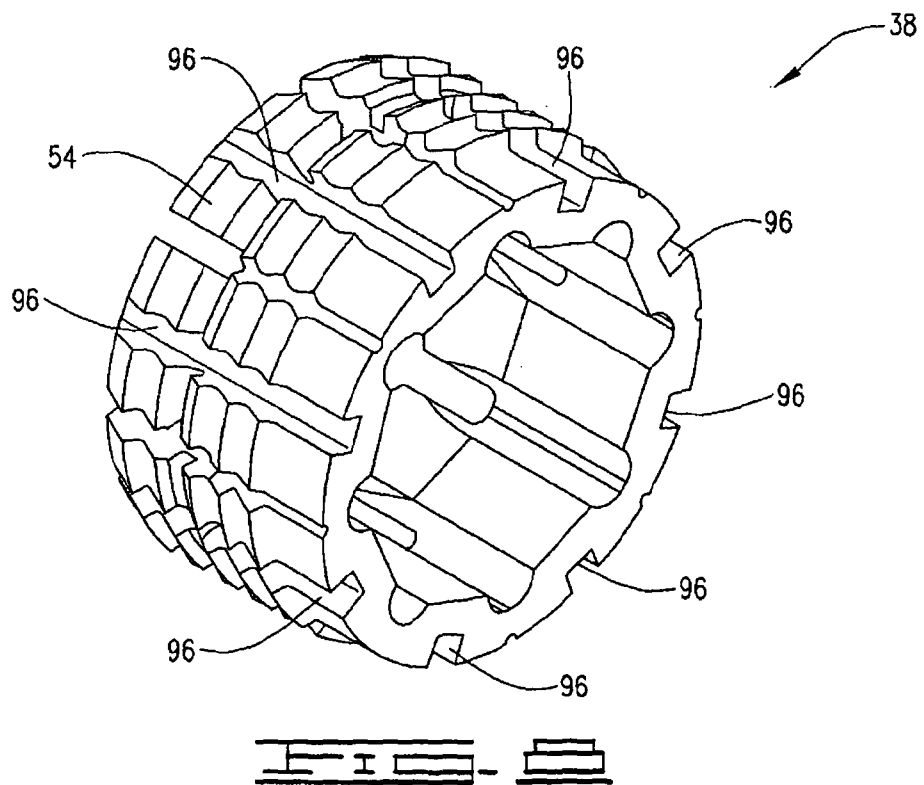
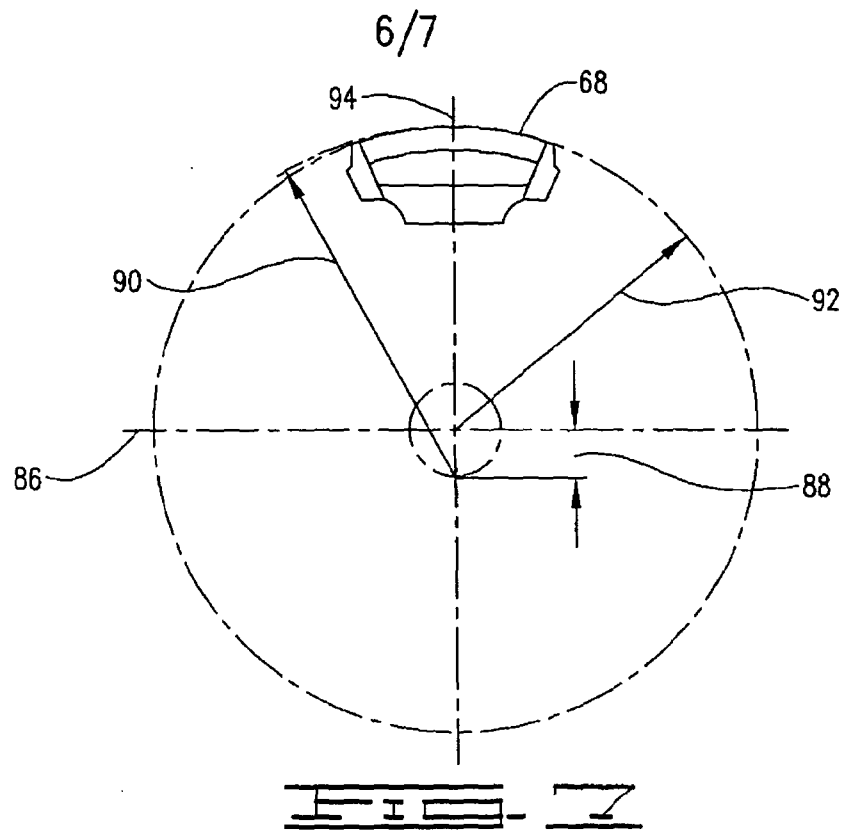


FIG. 5

+

+



+

+

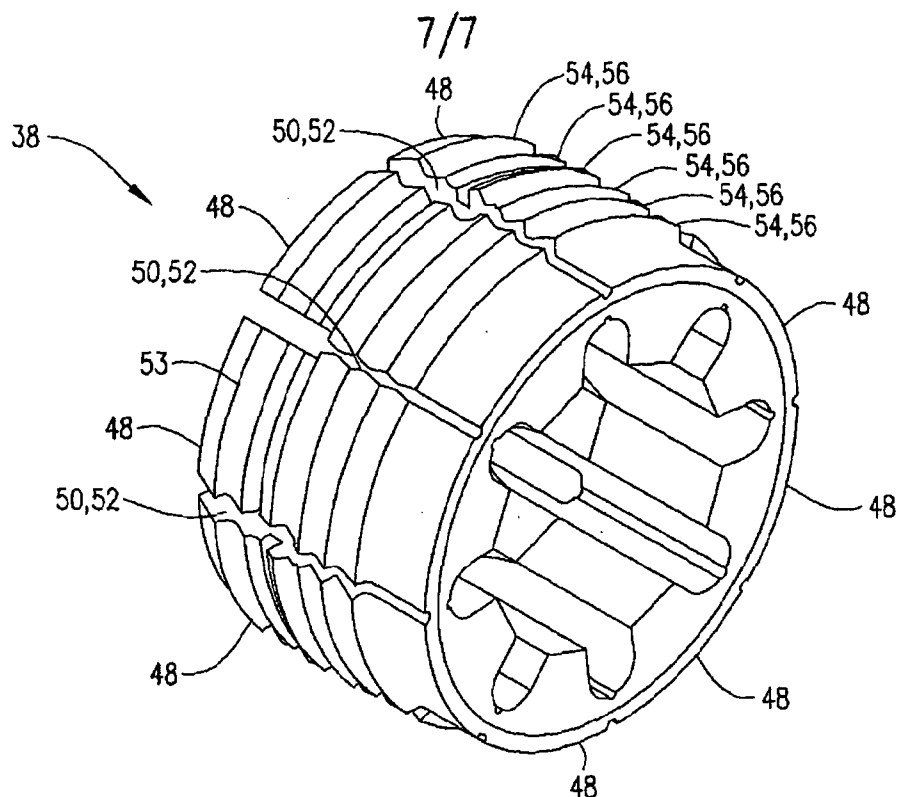


FIG. 9

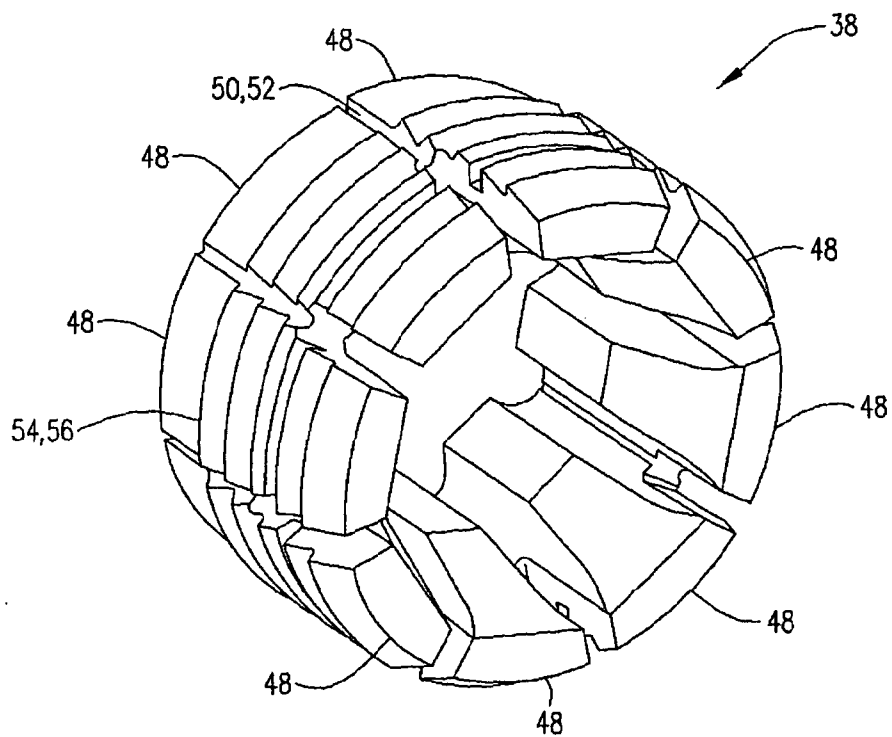


FIG. 10

+