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(54) Title: RESETTABLE BACKUP AND SYSTEM

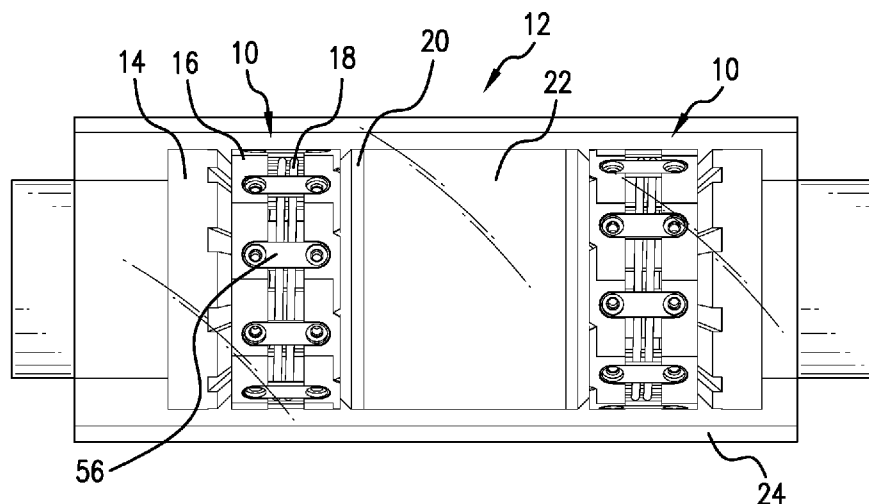


FIG. 1

(57) Abstract: A backup including a gage ring having frustoconical surface and a groove in the frustoconical surface, a segment having a nose engaged with the groove, the segment having an overlap finger and a finger receptor, a wedge ring in contact with the segment, and a retainer member disposed to retain the segment. The downhole tool further comprising a second backup also adjacent the element and spaced from the first backup by the element. A borehole system including a borehole in a subsurface formation, a string disposed within the borehole, a backup disposed within or as a part of the string. A borehole system including a borehole in a subsurface formation, a string disposed within the borehole, a tool disposed within or as a part of the string.

SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

**Declarations under Rule 4.17:**

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

**Published:**

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

## RESETTABLE BACKUP AND SYSTEM

### CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Application No. 17/565835, filed on December 30, 2021, which is incorporated herein by reference in its entirety.

### BACKGROUND

[0002] In the resource recovery and fluid sequestration industries, seals are ubiquitous. More recently, there has been growing interest in the ability to not only make a seal but to unmake the seal and move it before using the apparatus to make a seal again. This is difficult in view of the operational parameters of traditional back up members since they tend to experience plastic deformation in the setting process. Once plastically deformed, backups cannot be reset reliably. Solutions that allow for the desired resettability would be well received by the art.

### SUMMARY

[0003] An embodiment of a backup including a gage ring having frustoconical surface and a groove in the frustoconical surface, a segment having a nose engaged with the groove, the segment having an overlap finger and a finger receptor, a wedge ring in contact with the segment, and a retainer member disposed to retain the segment.

[0004] An embodiment of a downhole tool including an element, a first backup adjacent the element.

[0005] An embodiment of a borehole system including a borehole in a subsurface formation, a string disposed within the borehole, a backup disposed within or as a part of the string.

[0006] An embodiment of a borehole system including a borehole in a subsurface formation, a string disposed within the borehole, a tool disposed within or as a part of the string.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The following descriptions should not be considered limiting in any way. With reference to the accompanying drawings, like elements are numbered alike:

[0008] Figure 1 is a side view of a resettable backup as a part of a packer assembly;

[0009] Figure 2 is a cross sectional view of the assembly illustrated in Figure 1 in a nonset condition;

[0010] Figure 3 is a cross sectional view of the assembly illustrated in Figure 1 in a set condition;

[0011] Figure 4 is a perspective view of a gage ring of the backup as disclosed herein;

[0012] Figure 5 is a perspective view of a segment as disclosed herein in a first orientation;

[0013] Figure 6 is a perspective view of the segment of Figure 5 in a second orientation;

[0014] Figure 7 is a perspective view of a retainer member that makes up a part of the backup as disclosed herein;

[0015] Figure 8 is a view of the backup with a garter spring;

[0016] Figure 9 is a view of the backup with a C-Ring;

[0017] Figure 10 is a perspective view of the backup as disclosed herein in a set condition; and

[0018] Figure 11 is a view of a borehole system including the backup as disclosed herein.

## DETAILED DESCRIPTION

[0019] A detailed description of one or more embodiments of the disclosed apparatus and method are presented herein by way of exemplification and not limitation with reference to the Figures.

[0020] Referring to Figures 1-3, a backup 10 is illustrated as a part of a borehole tool 12, which as illustrated is a packer. The backup 10 includes a gage ring 14, a plurality of segments 16, a retention member 18 and a wedge ring 20. The tool 12, as illustrated only for example, includes two backups 10 and an element 22 between the two backups 10. This can also be appreciated from Figure 2, which illustrated Figure 1 in cross section. Upon setting, illustrated in Figure 3, the backups will deploy radially outwardly into close proximity or contact with a tubular 24 in which the tool 12 is to be set and the element 22 will be deployed radially outwardly into sealing contact with the tubular 24. The backups 10 will prevent extrusion of the element 22 due to pressure differential and/or boost loads across the tool 12. Uniquely, backup 10 can re-assume the exact condition it has in Figure 2 after it has been deployed to the condition of Figure 3 and can do this reliably, many times.

[0021] Focusing upon the backup 10, and referring to Figures 4-7, gage ring 14 includes a frustoconical portion 26 that includes radial grooves 28. Gage ring 14 assists to both drive the backup to a radially larger set position and to guide segments 16 to move radially outwardly and then back radially inwardly during unsetting so that the segments 16 do not move into positions where they might jam. Each segment 16 includes a number of features. Segments 16 number a plurality that are arranged in an annular form and nest with each other. In an embodiment, the segments 16 number 10. More or fewer could of course be used. Referring specifically to Figures 5 and 6, each segment 16 comprises a body 32. The body is made up of three portions identified as midportion 34, element portion 36 and gage portion 38. In an embodiment the midportion 34 is radially narrower than the element portion 36 and gage portion 38 to provide room for the retention member 18. Element portion 36 includes an overlap finger 40 and a finger receptor 42. Finger 40 also in an embodiment includes chamfers 44 and 46 to help prevent hang up during actuation. Further, in some embodiments the element portion 36 may include a seal enhancer 48 comprising a relatively softer material such as lead, copper, polymeric materials such as Polyether Ether Ketone (PEEK), rubber, etc. The gage portion 38 has a contact surface 50 that is intended to contact the tubular 24 when set. Finally, the illustrated embodiment also includes member hold down recesses 52 and 54 that will accept hold downs 56 (Fig. 1) to retain the retainer member 18 when assembled. Threaded holes 58 may be supplied for attachment of the hold down 56. It should be noticed that in an embodiment circumferential edges may be chamfered to avoid catching neighboring segments 16 or any other components of the backup 10. Referring to Figure 6, the segment 16 is flipped over to reveal the underside thereof. It will be noted that on gage portion 38 is a nose 60 and a gage chamfer 62. During use, the gage chamfer 62 slides along the frustoconical portion 26 while nose 60 rides in groove 28.

[0022] Referring to Figure 7, one embodiment of the retainer member 18 is illustrated in perspective view. In this embodiment, the member 18 is a solid material helically wrapped around a longitudinal axis of the member, which helps avoid becoming jammed with the segments 16 during use. This is as opposed to a coiled spring that is wrapped around the longitudinal axis, which springs could suffer individual coils being trapped between adjacent segments 16 when moving the backup 10 to the unset condition. Additionally, it can be seen in the Figure that the ends 64 and 66 are chamfered radially inwardly to further assist in avoiding a segment edge catching the member 18. The chamfer will also allow use of a garter type spring 19 despite the statement above with reduced risk of using the same, see

Figure 8. Also, a band type resilient construction such as a C-ring 21 is contemplated and illustrated in Figure 9.

[0023] Referring now to Figures 2, 3, and 10 the unset and set conditions are further illustrated. Figure 2 shows the backups 10 and indeed the entire tool 12 ( in this case a packer) in a running condition that is representative of the condition before and after setting. Figure 3 illustrated the same view in a set condition where it can be appreciated that the segments 16 of backups 10 have grown radially into contact with tubular 24, which of course is occasioned by the gage ring 14 and wedge 20 having a shorter longitudinal axial dimension between them. Figure 10 provides a perspective view of this set condition without other components of tool 12. From Figure 3, the element 22 can also be seen sealing against tubular 24 and another backup 10 also having been moved to the set condition. As noted above, the backups 10 may be moved to a set condition and an unset condition multiple times in order to set the tool 12, unset the tool 12 and reset tool 12 in the same or a different place.

[0024] A method for managing a borehole includes running the backup 10 in conjunction with the tool 12 or in conjunction with any other tool into a borehole system. The backup 10 is then set at will and unset at will, moved and set and unset again a multiplicity of times.

[0025] Referring to Figure 11, a borehole system 70 is illustrated. The system 70 includes a borehole 72 in a subsurface formation 74. Disposed in the borehole 72 is a string 76. Disposed within or as a portion of the string is a backup 10. The backup 10 may in some instances be a part of a tool 12.

[0026] Set forth below are some embodiments of the foregoing disclosure:

[0027] Embodiment 1: A backup including a gage ring having frustoconical surface and a groove in the frustoconical surface, a segment having a nose engaged with the groove, the segment having an overlap finger and a finger receptor, a wedge ring in contact with the segment, and a retainer member disposed to retain the segment.

[0028] Embodiment 2: The backup as in any prior embodiment wherein the retainer member is a solid material is disposed about a longitudinal axis of the member.

[0029] Embodiment 3: The backup as in any prior embodiment wherein the retainer member is a garter spring disposed about a longitudinal axis of the member.

[0030] Embodiment 4: The backup as in any prior embodiment wherein the retainer member is a C-ring disposed about a longitudinal axis of the member.

[0031] Embodiment 5: The backup as in any prior embodiment wherein the retainer member is a solid material helically wrapped around a longitudinal axis of the member.

[0032] Embodiment 6: The backup as claimed in claim 1 further comprising a hold down attached to the segment to retain the retainer member to the segment.

[0033] Embodiment 7: The backup as in any prior embodiment, wherein the segment includes threaded holes to secure the hold down to the segment.

[0034] Embodiment 8: The backup as in any prior embodiment wherein the overlap finger includes a chamfer.

[0035] Embodiment 9: The backup as in any prior embodiment further including hold down recesses in the segment.

[0036] Embodiment 10: A downhole tool including an element, a first backup as in any prior embodiment adjacent the element.

[0037] Embodiment 11: The downhole tool as in any prior embodiment, further comprising a second backup also adjacent the element and spaced from the first backup by the element.

[0038] Embodiment 12: A method for managing a borehole system including setting and unsetting the backup as in any prior embodiment a plurality of times.

[0039] Embodiment 13: A borehole system including a borehole in a subsurface formation, a string disposed within the borehole, a backup as in any prior embodiment disposed within or as a part of the string.

[0040] Embodiment 14: A borehole system including a borehole in a subsurface formation, a string disposed within the borehole, a tool as in any prior embodiment disposed within or as a part of the string.

[0041] The use of the terms “a” and “an” and “the” and similar referents in the context of describing the invention (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. Further, it should be noted that the terms “first,” “second,” and the like herein do not denote any order, quantity, or importance, but rather are used to distinguish one element from another. The terms “about”, “substantially” and “generally” are intended to include the degree of error associated with measurement of the particular quantity based upon the equipment available at the time of filing the application. For example, “about” and/or “substantially” and/or “generally” can include a range of  $\pm 8\%$  or  $5\%$ , or  $2\%$  of a given value.

[0042] The teachings of the present disclosure may be used in a variety of well operations. These operations may involve using one or more treatment agents to treat a formation, the fluids resident in a formation, a wellbore, and / or equipment in the wellbore,

such as production tubing. The treatment agents may be in the form of liquids, gases, solids, semi-solids, and mixtures thereof. Illustrative treatment agents include, but are not limited to, fracturing fluids, acids, steam, water, brine, anti-corrosion agents, cement, permeability modifiers, drilling muds, emulsifiers, demulsifiers, tracers, flow improvers etc. Illustrative well operations include, but are not limited to, hydraulic fracturing, stimulation, tracer injection, cleaning, acidizing, steam injection, water flooding, cementing, etc.

[0043] While the invention has been described with reference to an exemplary embodiment or embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the claims. Also, in the drawings and the description, there have been disclosed exemplary embodiments of the invention and, although specific terms may have been employed, they are unless otherwise stated used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention therefore not being so limited.

What is claimed is:

1. A backup (10) characterized by:
  - a gage ring (14) having frustoconical surface (26) and a groove (28) in the frustoconical surface (26);
  - a segment (16) having a nose (60) engaged with the groove (28), the segment (16) having an overlap finger (40) and a finger receptor (42);
  - a wedge ring (20) in contact with the segment (16); and
  - a retainer member (18) disposed to retain the segment (16).
2. The backup (10) as claimed in claim 1 wherein the retainer member (18) is a solid material is disposed about a longitudinal axis of the member (18).
3. The backup (10) as claimed in claim 1 wherein the retainer member (18) is a garter spring disposed about a longitudinal axis of the member (18).
4. The backup (10) as claimed in claim 1 wherein the retainer member (18) is a C-ring disposed about a longitudinal axis of the member (18).
5. The backup (10) as claimed in claim 1 wherein the retainer member (18) is a solid material helically wrapped around a longitudinal axis of the member (18).
6. The backup (10) as claimed in claim 1 further comprising a hold down (56) attached to the segment (16) to retain the retainer member (18) to the segment (16).
7. The backup (10) as claimed in claim 6, wherein the segment (16) includes threaded holes (58) to secure the hold down (56) to the segment (16).
8. The backup (10) as claimed in claim 1 wherein the overlap finger (40) includes a chamfer (44, 46).
9. The backup (10) as claimed in claim 1 further including hold down recesses (52, 54) in the segment (16).
10. A downhole tool (12) characterized by:
  - an element (22);
  - a first backup (10) as claimed in claim 1 adjacent the element (22).
11. The downhole tool (12) as claimed in claim 10, further comprising a second backup (10) also adjacent the element (22) and spaced from the first backup (10) by the element (22).
12. A method for managing a borehole system (70) characterized by:
  - setting and unsetting the backup (10) as claimed in claim 1 a plurality of times.
13. A borehole system (70) characterized by:
  - a borehole (72) in a subsurface formation (74);

a string (76) disposed within the borehole (72);  
a backup (10) as claimed in claim 1 disposed within or as a part of the string (76).

14. A borehole system (70) characterized by:

a borehole (72) in a subsurface formation (74);  
a string (76) disposed within the borehole (72);  
a tool (12) as claimed in claim 10 disposed within or as a part of the string (76) .

1/9

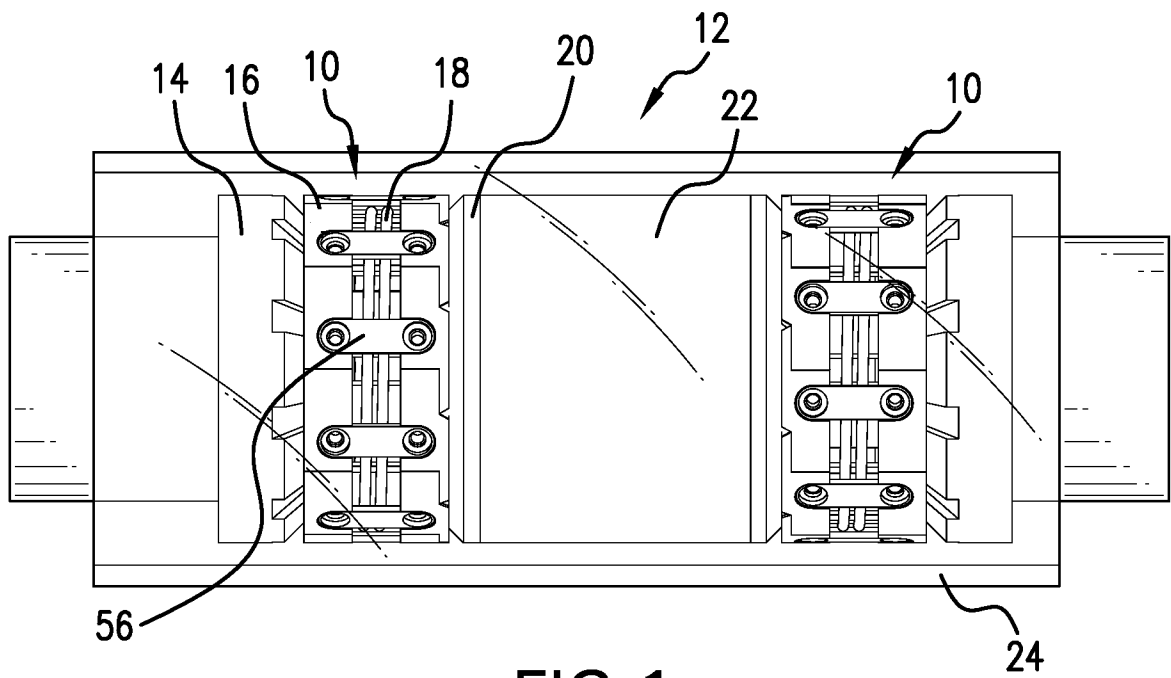


FIG. 1

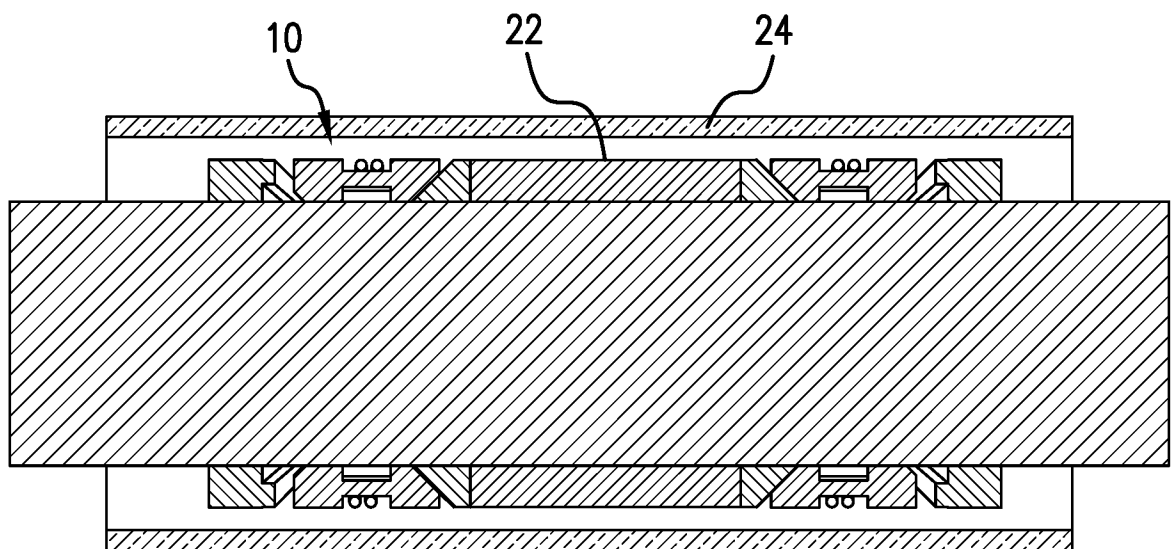


FIG. 2

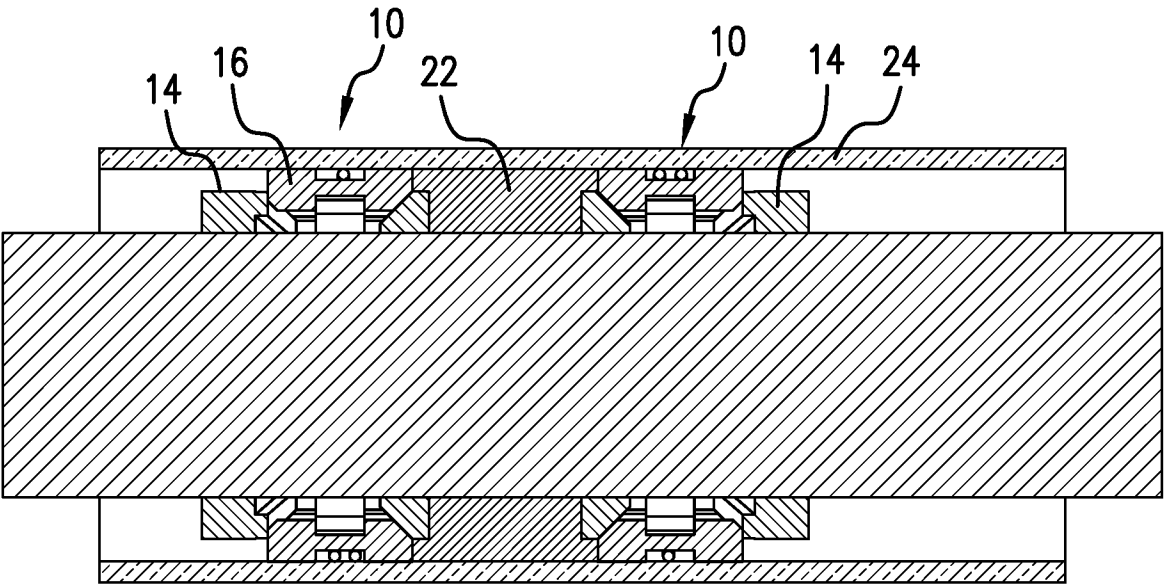


FIG.3

3/9

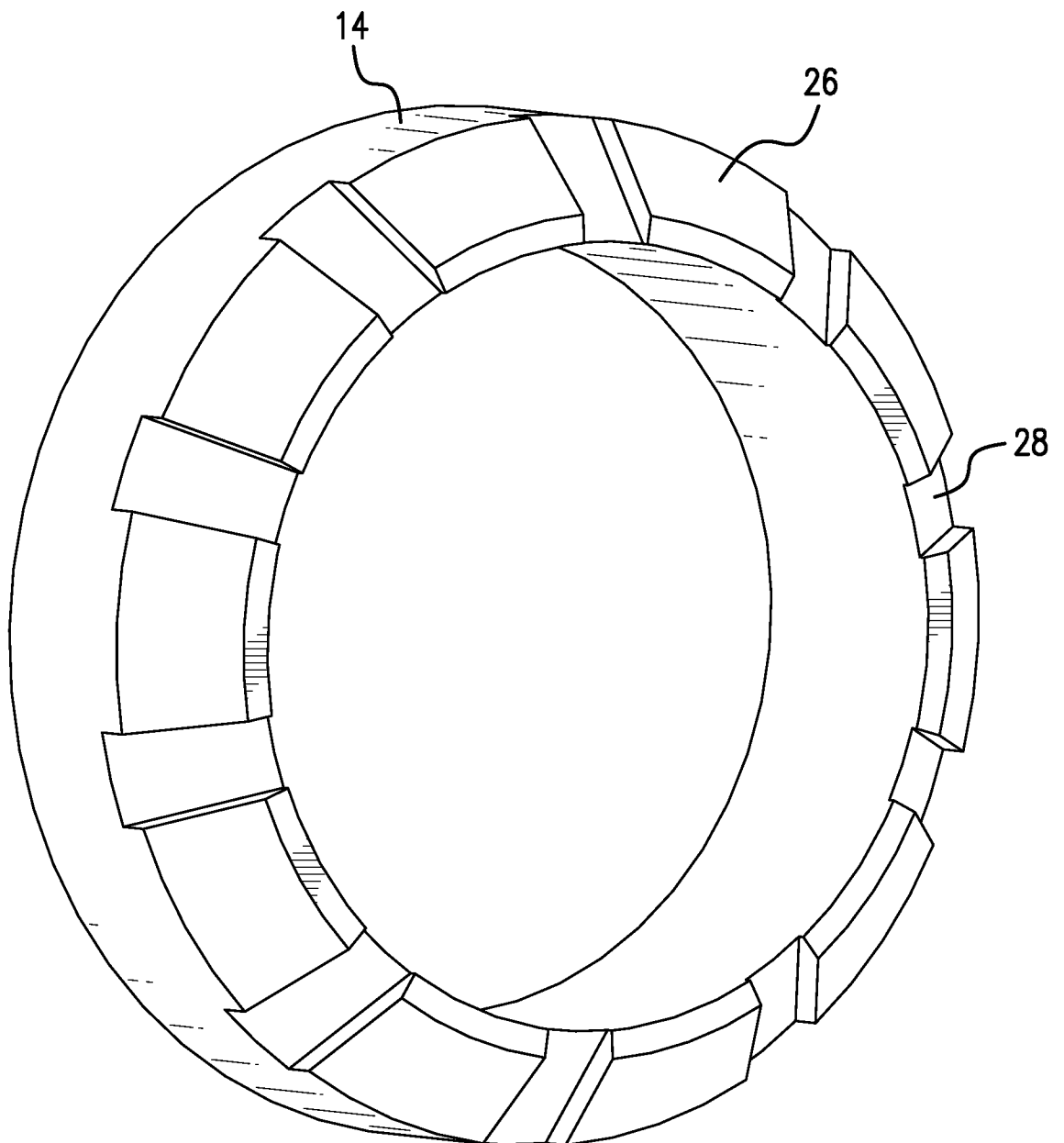


FIG. 4

4/9

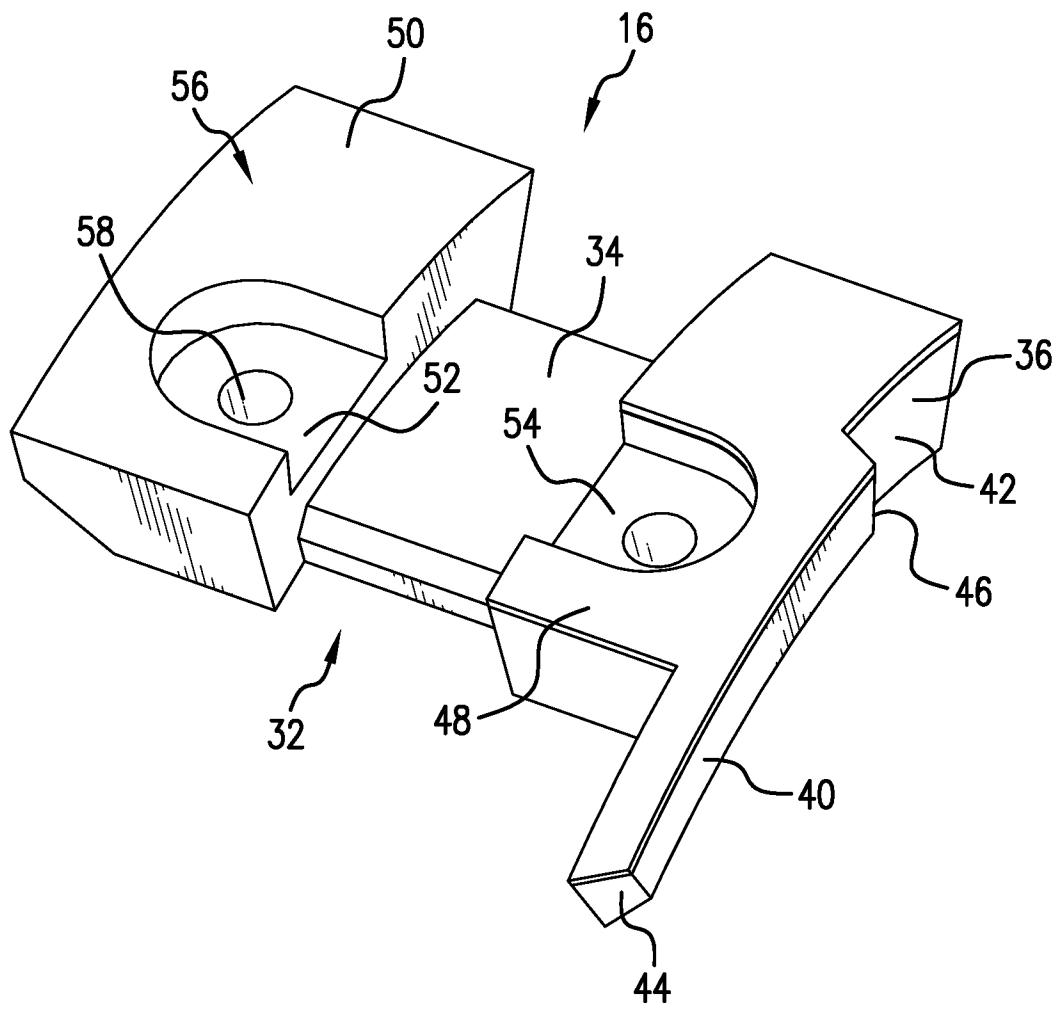


FIG. 5

5/9

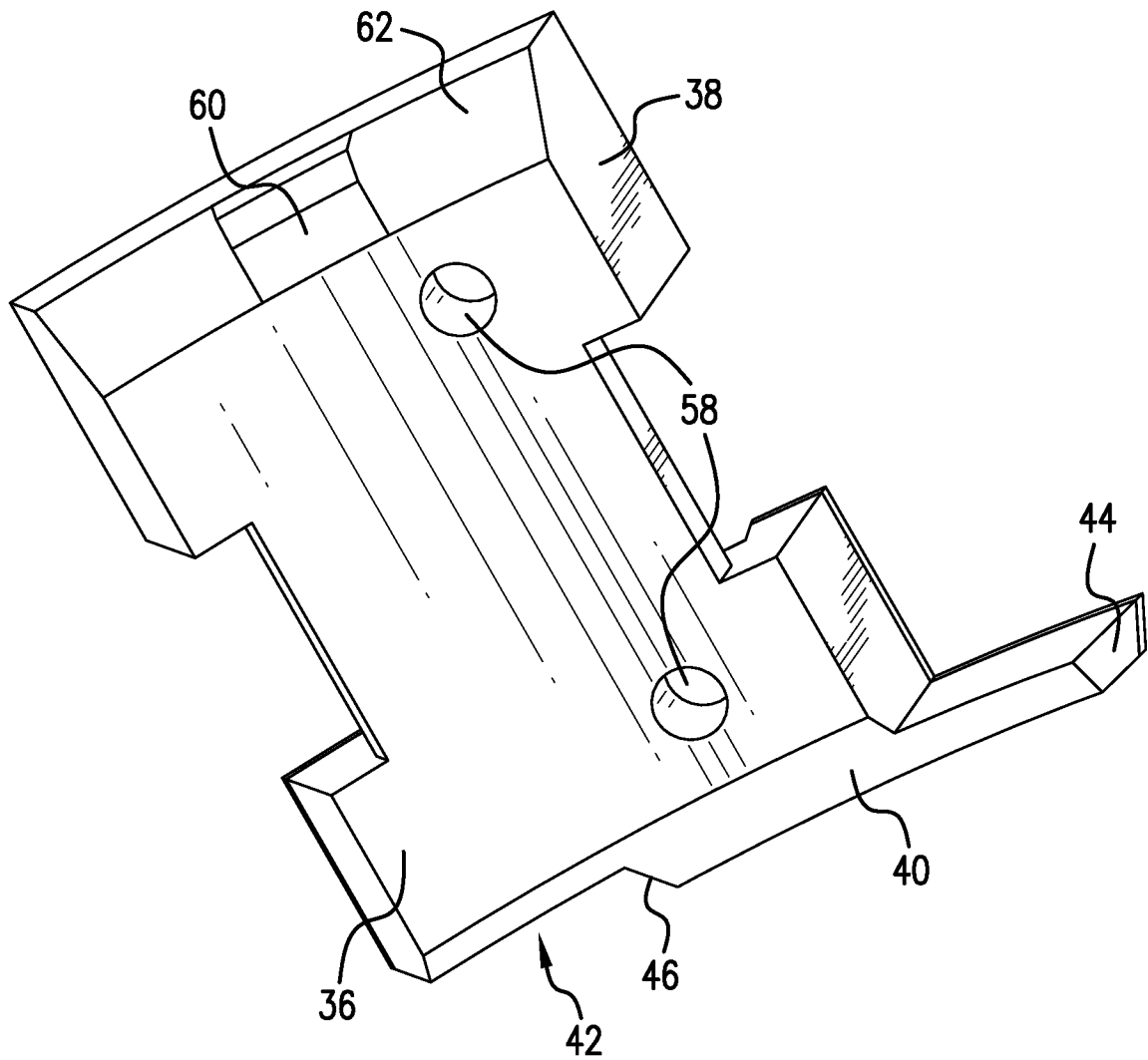


FIG. 6

6/9

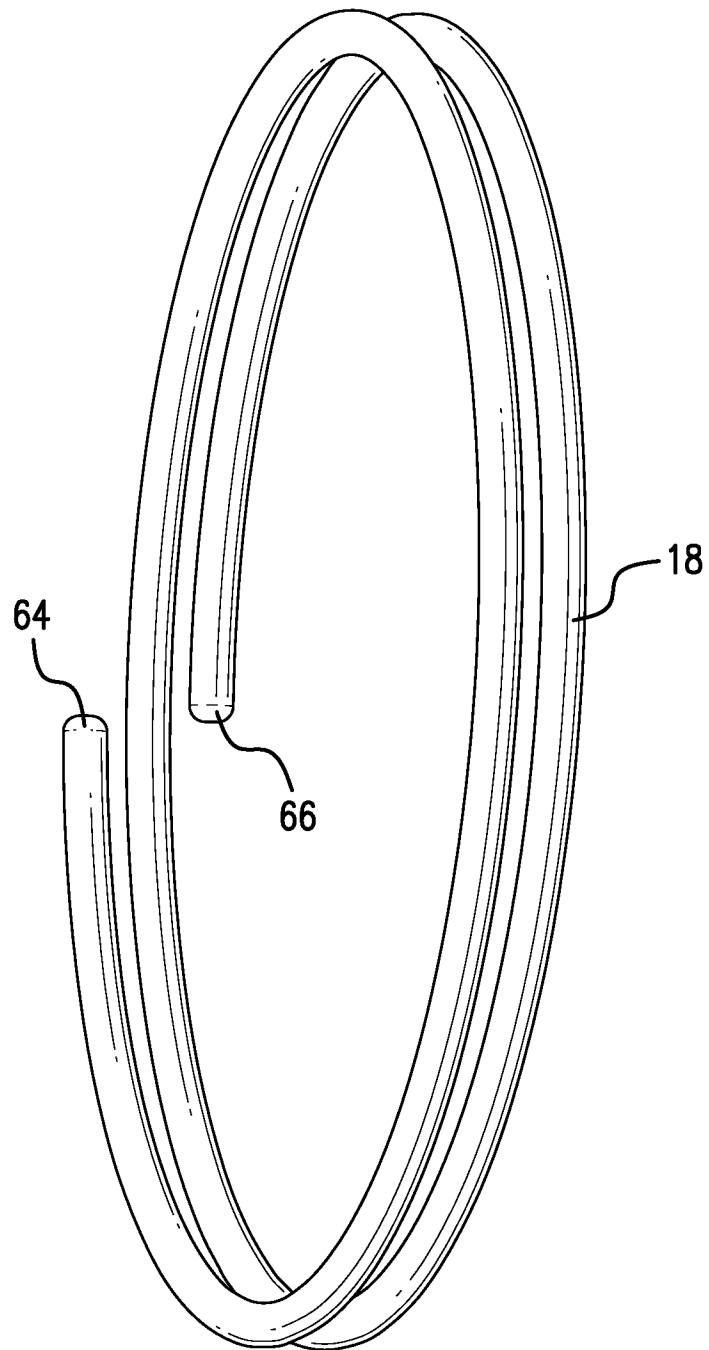


FIG. 7

7/9

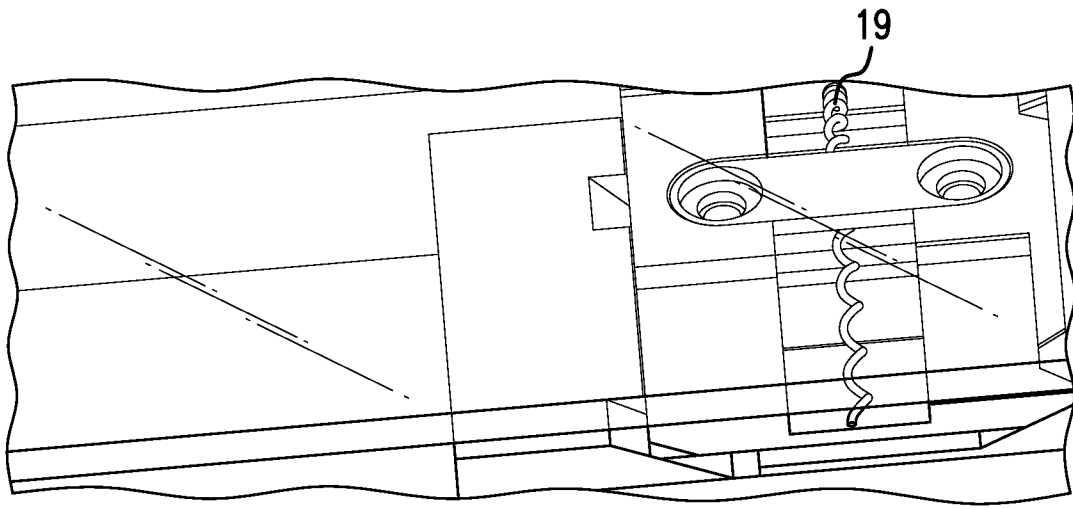


FIG. 8

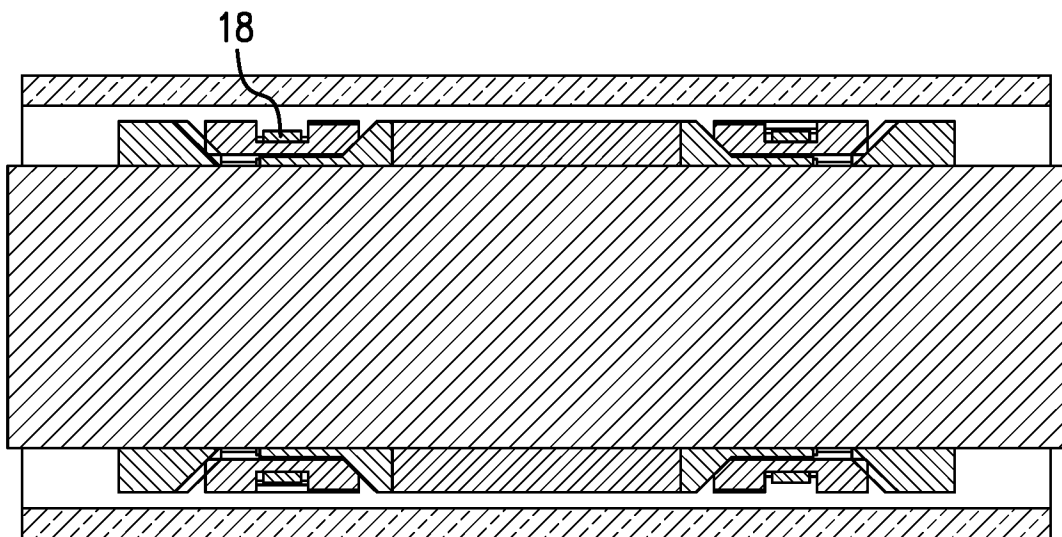


FIG. 9

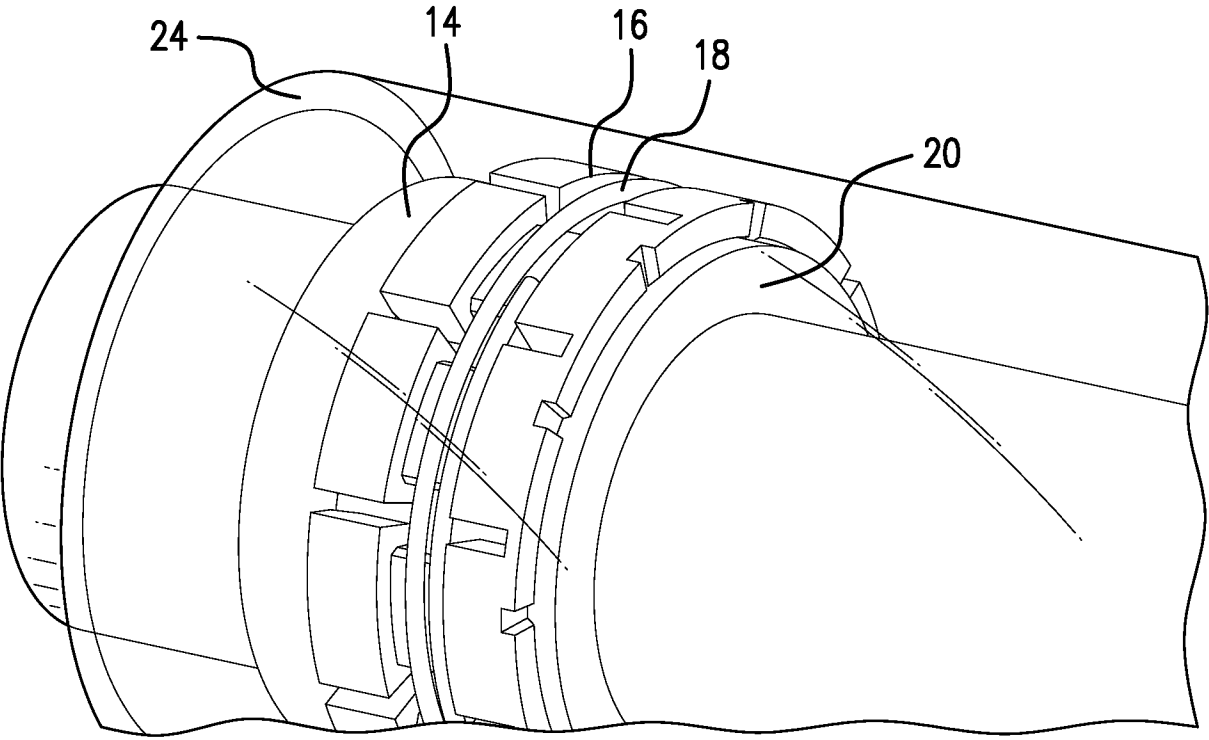


FIG.10

9/9

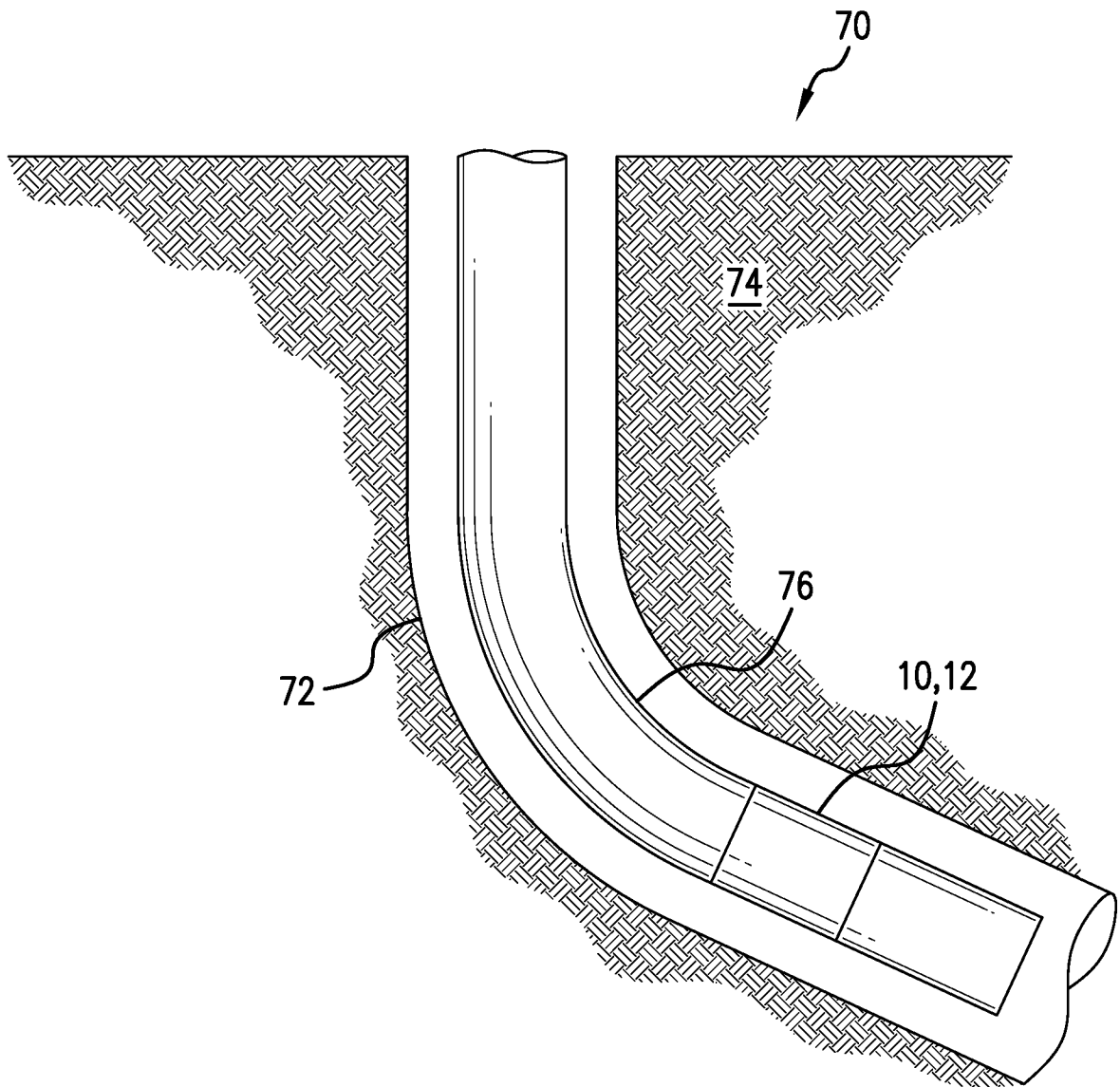


FIG.11

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2022/052948

**A. CLASSIFICATION OF SUBJECT MATTER****E21B 33/12(2006.01)i; E21B 23/06(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

E21B 33/12(2006.01); E21B 33/127(2006.01); E21B 33/129(2006.01)

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) &amp; Keywords: backup, gage ring, segment, wedge ring, retainer member, hold down

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                              | Relevant to claim No. |
|-----------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------|
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| Y         |                                                                                                                                 | 6-7,9                 |
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Further documents are listed in the continuation of Box C.



See patent family annex.

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“&amp;” document member of the same patent family

Date of the actual completion of the international search

21 April 2023

Date of mailing of the international search report

24 April 2023

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**INTERNATIONAL SEARCH REPORT**  
**Information on patent family members**

International application No.

**PCT/US2022/052948**

| Patent document<br>cited in search report |              |    | Publication date<br>(day/month/year) | Patent family member(s) |             |    | Publication date<br>(day/month/year) |
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