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(54) **PACKING ELEMENT AND METHOD**

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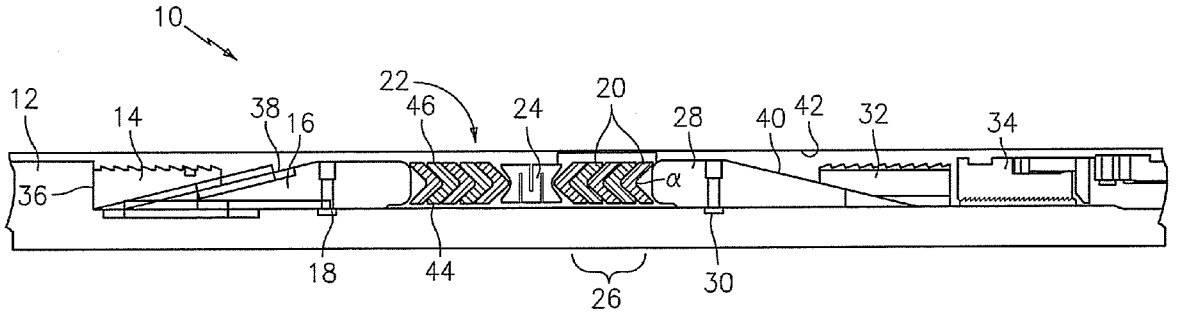
(57) **ABSTRACT**

A packing element includes a mandrel, at least one seal member having a Chevron shape and composed of a metal material, and an energizer in operable communication with the at least one seal member and a method for packing a tubular.



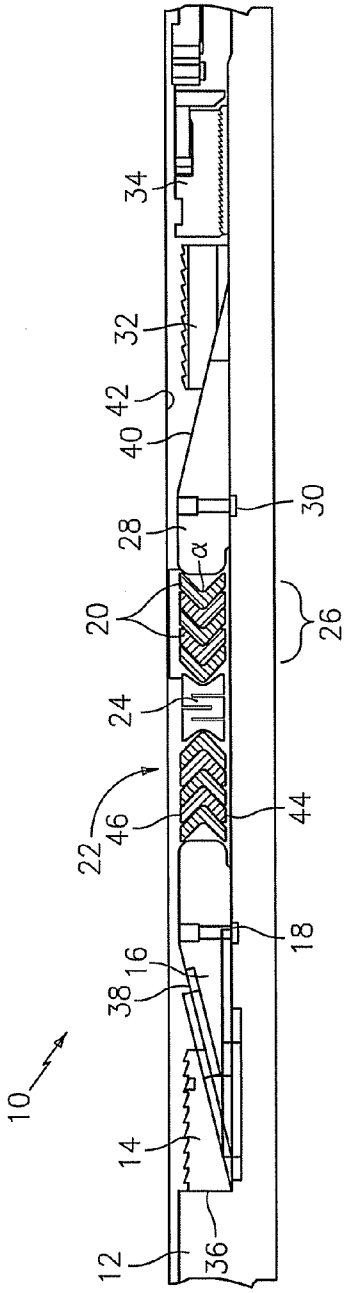


FIG. 1

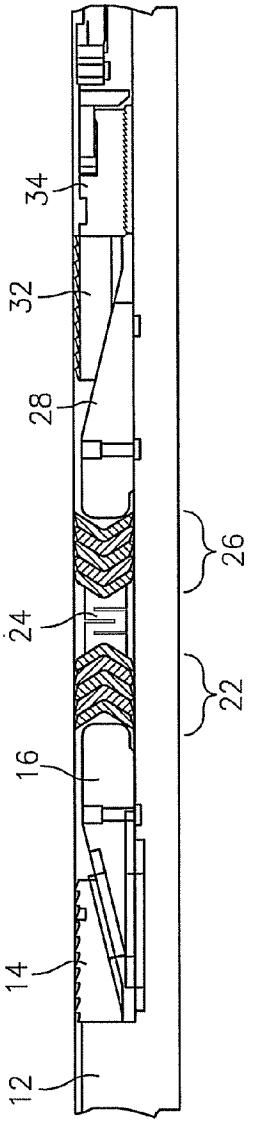


FIG. 2

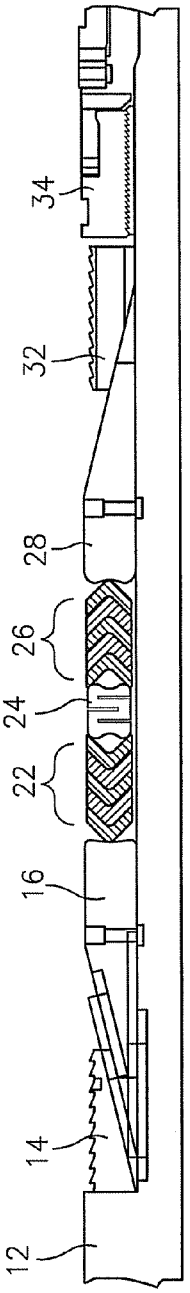


FIG. 3

PACKING ELEMENT AND METHOD

BACKGROUND OF THE INVENTION

[0001] Packing elements are well known and often used components of downhole operations. Packing elements are used for a number of different reasons in a number of different systems but generally all operate similarly. Packing elements are annular structures used to press against an inside or outside diameter of a target tubular, sometimes sealing thereagainst, to prevent all fluid communication past the packing element/tubular interface.

[0002] While the ubiquity of packing elements clearly evidences their effectiveness, it will be recognized by those of ordinary skill in the art that because of the elastomeric material utilized in most packing elements, degradation remains a problem for the art. The art is therefore always receptive to alternatives and especially those with greater robustness.

SUMMARY

[0003] A packing element includes a mandrel, at least one seal member having a Chevron shape and composed of a metal material, and an energizer in operable communication with the at least one seal member.

[0004] Further disclosed herein is a method of packing a tubular. The method includes compressing a packing element, splaying open at least one seal member to enlarge a radial dimension of the member, and maintaining energy in the at least one seal member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Referring now to the drawings wherein like elements are numbered alike in the several Figures:

[0006] FIG. **1** is a quarter section view of a packing element in accordance with this disclosure in the run in position;

[0007] FIG. **2** is a quarter section view of the element of FIG. **1** in the set position;

[0008] FIG. **3** is a quarter section view of an alternative arrangement of a packing element.

DETAILED DESCRIPTION OF THE DRAWINGS

[0009] Referring to FIG. **1**, one embodiment of a packing element **10** that is in one iteration free of elastomeric members is illustrated in the run-in position. The element **10** includes a mandrel **12** upon which is disposed a series of components. The components include (arbitrarily starting from an uphole end of the packing element **10**) a slip **14** in operable communication with a moveable ramp **16** disposed upon the mandrel; a release member **18** (such as a sheer screw) releasably attaching the moveable ramp **16** to the mandrel **12**; a series (one or more sealing elements **20**) of Chevron shaped seal members **22** disposed between the ramp **16** and an energizer **24**; another series (one or more sealing elements) of Chevron shaped seal member **26** disposed between the energizer **24** and another moveable ramp **28**; a release member **30** releasably attaching the ramp **28** to the mandrel **12**; a slip **32** in operable communication with the ramp **28**, and a ratchet assembly **34**.

[0010] The packing element **10** is set to create a seal, by being axially compressed which causes a compression of each of the components numerically identified above to an axially smaller area. That is, in order to set the element **10**, slip **14** is caused to reside more axially proximate to ratchet **34**. This can be effected by preventing movement of ratchet **34** while moving mandrel **12** in a direction that brings a mandrel shoulder **36** closer to ratchet **34**, thereby forcing all other components to also become closer to ratchet **34**; by moving mandrel **12** in the same direction while moving ratchet **34** in an opposing direction; and by fixing the mandrel in place and moving the ratchet **34** toward mandrel shoulder **36**. In each case, the axial distance between mandrel shoulder **36** and ratchet **34** is reduced thereby compressing all intermediary components into a smaller axial space. During such movement of the components hereof, the slips **14** and **32** are caused to move up ramp surfaces **38** and **40**, respectively, thereby moving slips **14** and **32** radially outwardly of mandrel **12** into interfacing contact with an inside surface **42** of a tubular (not otherwise shown). Slips **14** and **32** thus provide anchoring of the packing element **10**. The slips **14** and **32** are maintained in this position by ratchet assembly **34**, which ratchets in the direction of compression of the packing element **10** and prevents movement in an opposite direction. Contemporaneously with the movement of slips **14** and **32**, and as noted above, movable ramps **16** and **28** are also urged to move toward one another. In the illustrated embodiment, movement is unidirectional, though collectively converging. This can be noted from a review of FIG. **2** with specific attention focused upon release members **18** and **30**, which are illustrated as shear members, in the sheared position. The converging relative movement of movable ramps **16** and **28** causes an axial load to be applied to seal members **22** and **26** as well as to energizer **24**, positioned therebetween. In the compressed condition, the seal members **22** and **26** tend to yield to a configuration that is flatter, or alternatively stated, more radially directed than the condition in which they exist when at rest, (see FIGS. **1** and **2** in comparison). Due to the Chevron shape of each sealing element **20** of seal members **22** and **26**, a flattening, i.e. a growth, or splaying open of an inside angle alpha, necessarily translates to an increasing radial distance between an inside edge **44** and an outside edge **46** of each sealing element **20** of each seal member **22** and **26**. Radial growth is precisely what is needed to seal the annulus between mandrel **12** and inside diameter **42**. In addition, because of the directional nature of the seal members **22** and **26**, utilizing both directions in a single packing element **10** ensures that pressure is held from both directions.

[0011] Energizer **24**, which is a resilient member such as a spring, ensures that sealing energy stays in the seal members even after multiple pressure reversals in the downhole environment. Such pressure reversals have been a cause of seal leakage and such is avoided in the context of the invention by employing the energizer **24**.

[0012] In an alternate embodiment, referring to FIG. **3**, the direction of the seal members **22** and **26** is reversed. Sealing is, however, effected in substantially the same way as the forgoing embodiment since the same forces are not at work to cause an enlargement of the angle alpha in the Chevron shaped members thereby increasing their radial dimensions.

[0013] In the foregoing embodiments, the seal members comprise non-elastomeric materials to enhance resistance of the packing element to downhole environmental conditions thereby ensuring a long, useful life of the element.

[0014] Because of the particular configuration of the sealing elements **20** of each seal member **22** and **26**, a series of relatively narrow annular seal areas are created against both the inside surface **42** of a target tubular and the mandrel **12**. This means that ridges and other surface irregularities of the target tubular are much more easily accommodated than with

prior art packing elements having a broader contact surface in one element, where bridging might occur. For example, if a target tubular presents a series of annular irregularities, each of the individual sealing elements **20** of the seal members **22** and **26** will automatically adjust to the surface by extending more radially outwardly (limited of course to a maximum radial expansion related to total axial compression and the ability of the seals to flatten) or by being more highly loaded against a "high spot" on the casing so that the individual sealing element member does not expand radially to its otherwise fullest potential. Due to this property, the individual sealing element will create individual annular seals that together combine to create a more competent packing element while being exceptionally robust.

[0015] It is to be appreciated that while a pair of slips is shown and a pair of sealing members is shown, singles of each is also workable while still maintaining good sealing properties of the packing element. In such a configuration, the seal members **20** or even the energizer **24** could be arranged to abut the mandrel shoulder **36**, for example, so that energy is storable in the packing element through axial compression thereof against the shoulder **36** or similar.

[0016] In yet another embodiment, where anchoring is not needed or desired, the seal members **22** (or **22** and **26**) may be employed alone with such as ratchet assembly **34** to hold energy in the seals.

[0017] While preferred 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 packing element comprising:
a mandrel;
at least one seal member having a Chevron shape and composed of a metal material; and
an energizer in operable communication with the at least one seal member.

2. The packing element as claimed in claim **1** wherein the element further comprises at least one slip and at least one ramp in operable communication with the mandrel.

3. The packing element as claimed in claim **2** wherein the at least one ramp is movable on the mandrel.

4. The packing element as claimed in claim **2** wherein the at least one slip and at least one ramp is two slips and two ramps, one of each operable as a set and responsive to axial compression along the mandrel to increase an outside diameter of each slip and ramp combination.

5. The packing element as claimed in claim **1** wherein the at least one seal member comprises a stack of seal member elements.

6. The packing element as claimed in claim **1** wherein the at least one seal member is two seal members having a direction of the Chevron shape of each member opposed.

7. The packing element as claimed in claim **1** wherein the energizer is a resilient member.

8. The packing element as claimed in claim **1** wherein the energizer is a spring member.

9. The packing element as claimed in claim **1** wherein the at least one seal member when actuated creates a series of relatively narrow annular seals with a target tubular.

10. The packing element as claimed in claim **9** wherein the series of seals are at different relative diameters.

11. A method of packing a tubular comprising:
compressing a packing element as claimed in claim **1**;
splaying open at least one seal member to enlarge a radial dimension of the member; and
maintaining energy in the at least one seal member.

12. The method of packing a tubular as claimed in claim **11** wherein the compression is axial.

13. The method of packing a tubular as claimed in claim **11** wherein the splaying of at least one seal member is splaying open of a number of sealing elements to cause a number of relatively narrow annular seals to form against a target tubular.

14. The method of packing a tubular as claimed in claim **13** wherein the relatively narrow annular seals have different diameters.

15. The method of packing a tubular as claimed in claim **11** wherein the maintaining is by compressing an energizer to store energy that is automatically released upon a reduction in axial compression of the packing element.

16. The method of packing a tubular as claimed in claim **11** wherein the maintaining is by setting a ratcheting assembly.

17. The method of packing a tubular as claimed in claim **11** wherein the at least one seal member is a number of seal members, the members each including at least one sealing element.

18. The method of packing a tubular as claimed in claim **17** wherein the seal members are a mirror image of one another.

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