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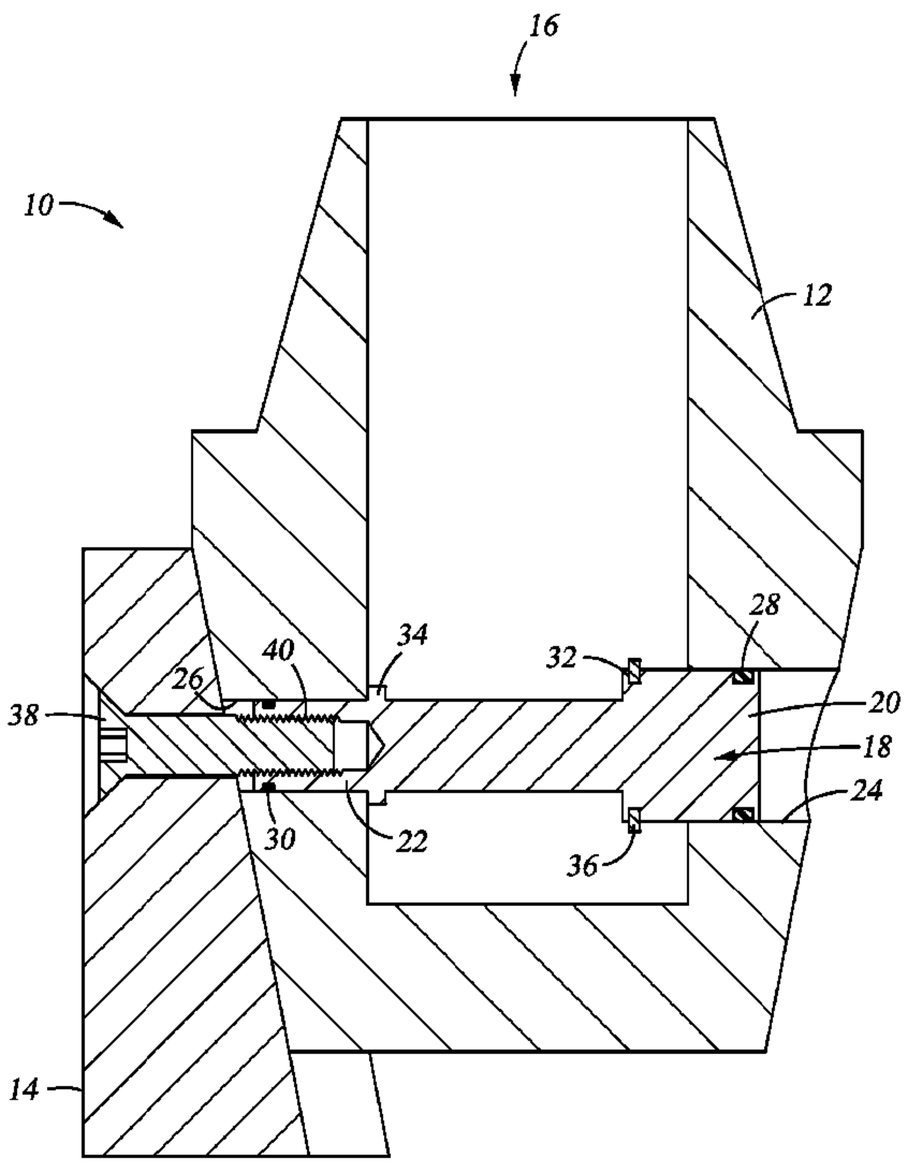


Fig. 1

(57) Abrégé/Abstract:
An affixation and release arrangement includes a first component having a fluid pressure chamber; a piston mounted in the first component and exposed to the fluid pressure chamber; a second component affixed to the first component through the piston, the piston responsive to fluid pressure increase within the chamber to unaffix the second component from the first component. Methods are included.

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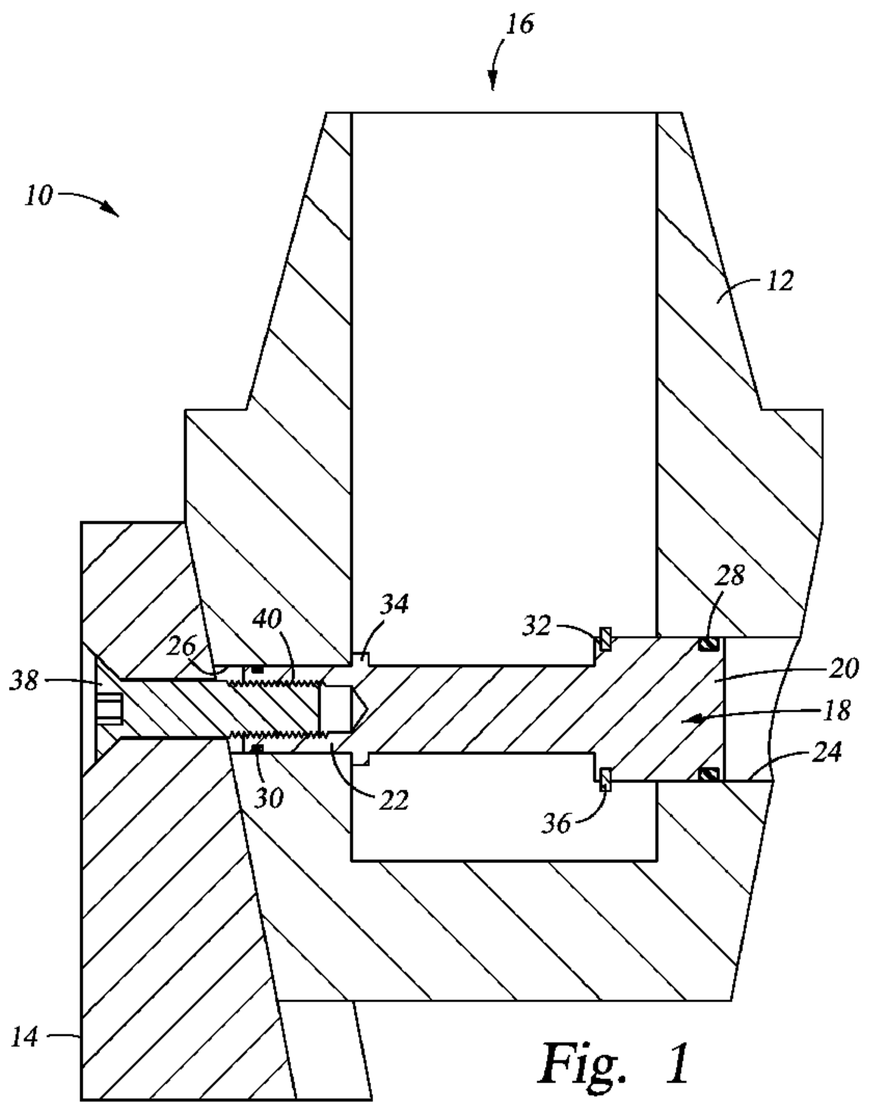


Fig. 1

(57) Abstract: An affixation and release arrangement includes a first component having a fluid pressure chamber; a piston mounted in the first component and exposed to the fluid pressure chamber; a second component affixed to the first component through the piston, the piston responsive to fluid pressure increase within the chamber to unaffix the second component from the first component. Methods are included.

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HYDRAULICALLY RELEASED WINDOW MILL

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BACKGROUND

[0001] In the hydrocarbon industry it is common to run a whipstock and a mill in the same run by hanging the whipstock from the end of the mill string. Generally this is done by using a bolt at an uphole end of the whipstock that runs into the mill to support the weight of the whipstock during run in. Once the whipstock has landed at a selected position and orientation within the borehole, the whipstock is anchored in place and will bear weight. The mill is then separated from the whipstock by set down weight on the bolt that extends from the whipstock to the mill. The bolt is sheared to effect separation. Because the whipstock is necessarily thinner at the uphole end thereof, it has commonly been a practice in the industry to use a lug at the uphole end of the whipstock to support the shear load with minimal distortion of the whipstock. While this arrangement does tend to work as planned, it also presents a heavy piece of material that is significantly less than a full circle thereby guaranteeing an interrupted cut. Such interrupted cuts are known to damage the mill but this has traditionally been endured due to the lack of any alternative arrangement that will function more favorably.

SUMMARY

[0002] An affixation and release arrangement for a whipstock and a mill in a borehole comprises: a mill having a fluid pressure chamber; a piston mounted in the mill and exposed to the fluid pressure chamber; and a whipstock affixed to the mill through the piston, the piston responsive to applied fluid pressure from surface within the chamber to unaffix the whipstock from the mill.

[0003] A method for releasing a mill and whipstock combination comprises pressuring a piston within a chamber of the mill; loading a fastener with the piston; overcoming the fastener; and releasing the mill from the whipstock.

[0004] A method for releasing a mill and whipstock combination including pressuring a piston within a chamber of the mill; loading a securement engaged with the piston; overcoming the securement; releasing the mill from the whipstock.

BRIEF DESCRIPTION OF THE DRAWINGS

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

Figure 1 is a schematic view of a mill connected to a whipstock with a piston actuated affixation arrangement as taught herein;

Figure 2 is a schematic view of the mill and whipstock disconnected by piston actuation;

Figure 3 is a schematic view of an alternate embodiment.

DETAILED DESCRIPTION

[0006] Referring to **Figure 1** an affixation and release arrangement **10** is illustrated. The specifically depicted embodiment is an affixation between a first component such as a mill **12** and a second component such as a whipstock **14** but it is to be appreciated that the concept hereof can be extended to other affixations that require separation. Referring directly to the Figures, the mill **12** defines a chamber **16** therein. A piston **18** is disposed in pressure communication with the chamber **16** such that a change in pressure in the chamber will cause a change in position of the piston **18**. In one embodiment, the arrangement is configured to cause the piston **18** to move upon a pressure increase in the chamber **16**. In the illustrated embodiment, this is affected by configuring the piston **18** with a differential area end to end. Hence upon increased pressure, the piston will move. Addressing specifically the differential area of the piston **18**, it is noted that in the illustration, the portion of the piston **18** that for convenience is referred to here as piston head **20**, on the right side of drawing **Figure 1** is of a dimension that is larger than that of a portion of the piston 18, referred to herein for convenience as piston tail **22**. Piston head **20** and piston tail **22** are accommodated laterally in the mill **12** in bores **24** and **26** that are sized to promote fluid pressure sealability with the piston head **20** and piston tail **22**, respectively. Sealing is enhanced by the provision of seals **28** and **30** at each of piston head **20** and piston tail **22**. In one embodiment the seals **28** and **30** are o-rings. In the condition of

piston **18** as described it will be evident to one of ordinary skill in the art that increasing fluid pressure in chamber **16** will cause the piston **18** to move toward the end thereof that is of greater area. In the configuration described above this is toward piston head **20**. This also corresponds to the right side of the figure as illustrated.

[0007] In order to prevent the piston from moving too far in either direction the illustrated embodiment is configured with stops **32** and **34**. These are in one embodiment as illustrated with stop **32** being a snap ring received in a groove **36** and stop **32** being a piece of the piston **18** itself. It will be understood however that these can be reversed or the stop function otherwise accomplished. In the specifically illustrated embodiment the construction is related to ease of manufacture of the arrangement **10** since in this configuration the entire piston **18** is insertable through the bore **24** and then the snap ring **32** may be engaged with the groove **36** through chamber **16**. Because in the setting of the illustrated embodiment there is no reason that reengagement would be desired, there is no reason to include a biasing member to urge the piston **18** in a direction opposite that of the direction of movement under increased chamber fluid pressure. It will be appreciated however, that in other embodiments utilizing the same concept as the embodiment illustrated might benefit from a biasing member and hence in such an arrangement a biasing member such as a spring would be located to act in a direction opposite the direction of fluid pressure movement such as in compression between the ring **32** and the chamber wall directly to the right of the ring **32** in the Figure, for example, or might be located to act in a same direction as the direction of fluid pressure movement such as between the stop **34** and the chamber wall directly to the left of the stop **34** in the Figure, for example.

[0008] The whipstock **14**, for run in, is secured to the mill **12** by a fastener **38** that is in affixed relationship with the piston **18**. In one embodiment, the affixed relationship is a threaded or press fit relationship at interface **40**. In some embodiments the threaded engagement, press fit engagement or the fastener itself may be overcome solely by the pressure based movement of the piston resulting in release of the mill **12** from the whipstock **14**. In other embodiments however, it is contemplated that a parting configuration be provided in the fastener. Such parting configurations may present as a groove in the fastener to reduce tensile capacity thereof, a heat-treated area for the same purpose, or other similar treatments that will reduce strength of the

fastener. In some embodiments the reduction is strength of the fastener will be concentrated in a reduction in tensile strength while substantially preserving shear and/or bending strength. In each case, the parting configuration is configured to cause parting of the fastener **38** below a surface **42** of the whipstock face to ensure that the fastener will not itself present an impediment to mill **12** advancement.

[0009] With the fastener **38** secured to the piston **18,** through an uphole end of whipstock **14**, the whipstock **14** is affixed to the mill **12** and remains that way until the arrangement is actuated by increasing fluid pressure in chamber **16**. Fluid pressure can be increased in a number of ways such as by pump or by heaters or by energetic compounds (particularly if the chamber **16** is configured as an enclosed space), etc. and the pressure can be locally generated or remote as desired.

[0010] In use, the arrangement is run into the hole in the condition illustrated in Figure 1 and located by suitable means. Once the whipstock is at final destination and orientation the pressure is increased in chamber **16** whereby the piston **18** is moved to the right of the drawing Figure and the fastener **38** parts, which is illustrated in **Figure 2**. Once the arrangement **10** has achieved the condition illustrated in **Figure 2**, the mill **12** is free to move relative to the whipstock **14**. Because there is no remaining bolt or lug to be milled off the whipstock **14**, there is far less eccentric cut experienced by the mill when advancing to its primary objective. The life of the mill is therefore extended and the job it can do enhanced since it has not experienced a difficult eccentric cut, as has traditionally been the case.

In an alternate embodiment, referring to **figure 3**, the piston **118** is configured differently. The piston **118** itself extends through the whipstock **14** and is secured at an opposite surface **44** to the face surface **42**. In the specifically illustrated embodiment, a securement **48** is secured in a groove **50** of the piston **118**. This ring **48** may be a snap ring, an e clip, etc. Further the securement **48** may be a roll pin or other similar structure (also considered schematically represented by **figure 3**). In this embodiment, upon the application of fluid pressure within chamber **16,** piston **118** is urged as it was in the previously described embodiment but instead of parting the fastener as shown in **Figure 2**, the securement **48** is disengaged from the piston **118**. Disengagement may be by shear, deformation, etc. as long as it is no longer in a position to hold the piston in place and thereby allows the fluid pressure to move the

piston **118** in a direction that will disengage the piston itself from the whipstock (to the right in the figure). In this embodiment, there is no component of the securement left in the whipstock and hence no concern that such component might come loose and interfere with a well operation.

[0011] While preferred embodiments have been shown and described, various modifications and substitutions may be made thereto without departing from the scope of the invention. Accordingly, it is to be understood that the present invention has been described by way of illustration and not limitation.

What is claimed is:

1. An affixation and release arrangement for a whipstock and a mill in a borehole comprising:

a mill having a fluid pressure chamber;

a piston mounted in the mill and exposed to the fluid pressure chamber; and

a whipstock affixed to the mill through the piston, the piston responsive to applied fluid pressure from surface within the chamber to unaffix the whipstock from the mill.

2. An affixation and release arrangement as claimed in claim 1, wherein the whipstock is affixed to the mill by a fastener.

3. An affixation and release arrangement as claimed in claim 2, wherein the fastener is threaded.

4. An affixation and release arrangement as claimed in claim 2, wherein the fastener is a press fit fastener.

5. An affixation and release arrangement as claimed in claim 2, wherein the fastener includes a parting feature.

6. An affixation and release arrangement as claimed in claim 5, wherein the parting feature facilitates parting under tensile load.

7. An affixation and release arrangement as claimed in claim 5 or 6, wherein the parting feature preserves fastener strength in at least one of shear and bending.

8. An affixation and release arrangement as claimed in claim 1, wherein the whipstock is affixed to the mill by a securement to the piston.

9. An affixation and release arrangement as claimed in claim 8, wherein the securement is a ring.

10. An affixation and release arrangement as claimed in claim 8, wherein the securement is a pin.

11. An affixation and release arrangement as claimed in any one of claims 1 to 10, wherein the piston includes a piston head and a piston tail, the piston head having greater area than the piston tail.

12. An affixation and release arrangement as claimed in claim 11, wherein each of the piston head and the piston tail includes stops.

13. A method for releasing a mill and whipstock combination comprising:

(a) pressuring a piston within a chamber of the mill;

(b) loading a fastener with the piston;

(c) overcoming the fastener; and

(d) releasing the mill from the whipstock.

14. A method as claimed in claim 13, wherein the pressuring is by applied pressure from a surface location.

15. A method as claimed in claim 13, wherein the pressuring is local to the mill and whipstock.

16. A method as claimed in any one of claims 13 to 15, wherein the loading of the fastener is tensile.

17. A method as claimed in claim 13, wherein the overcoming of the fastener is parting of the fastener.

18. A method for releasing a mill and whipstock combination comprising:

(a) pressuring a piston within a chamber of the mill;

(b) loading a securement engaged with the piston;

(c) overcoming the securement; and

(d) releasing the mill from the whipstock.

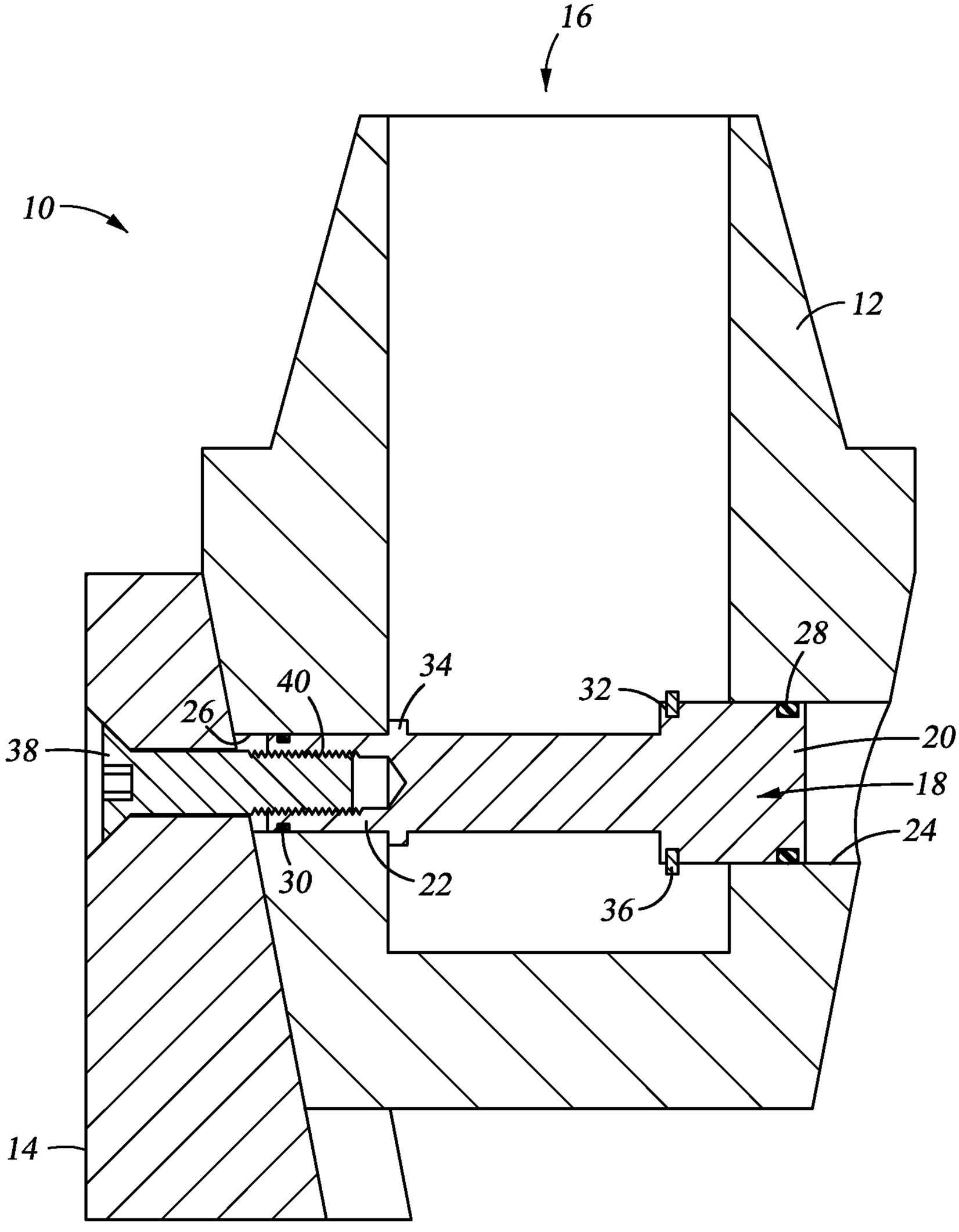


Fig. 1

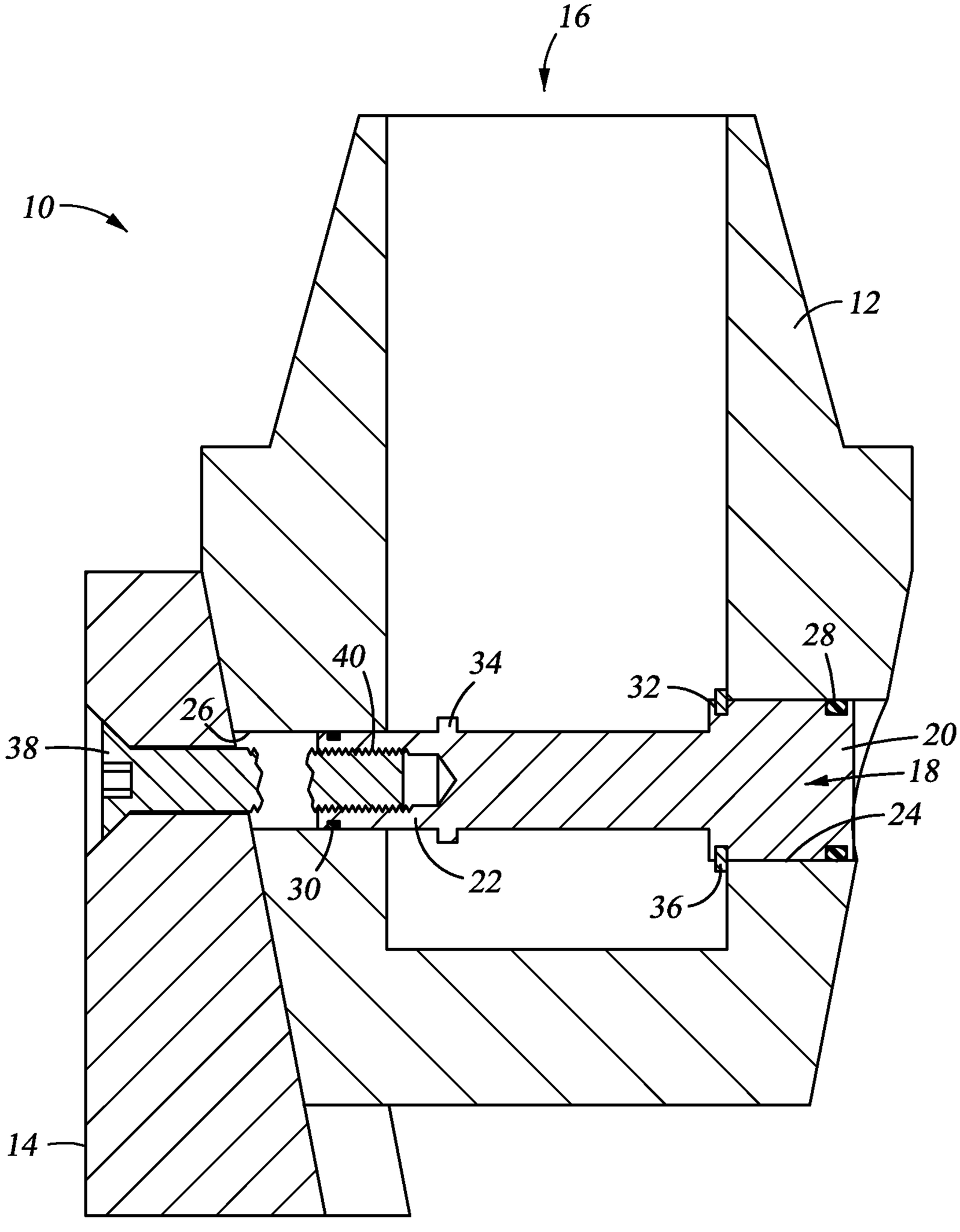


Fig. 2

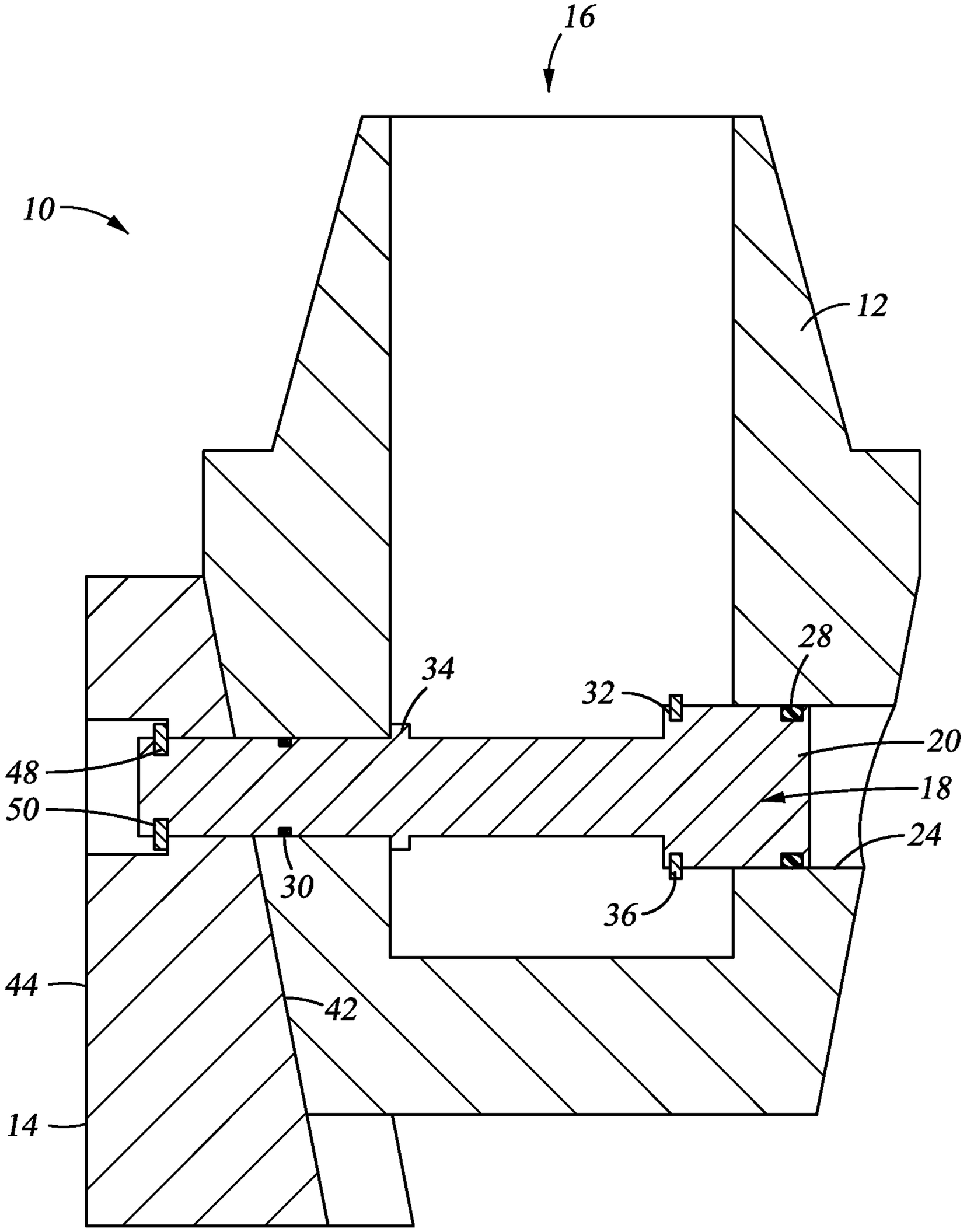


Fig. 3

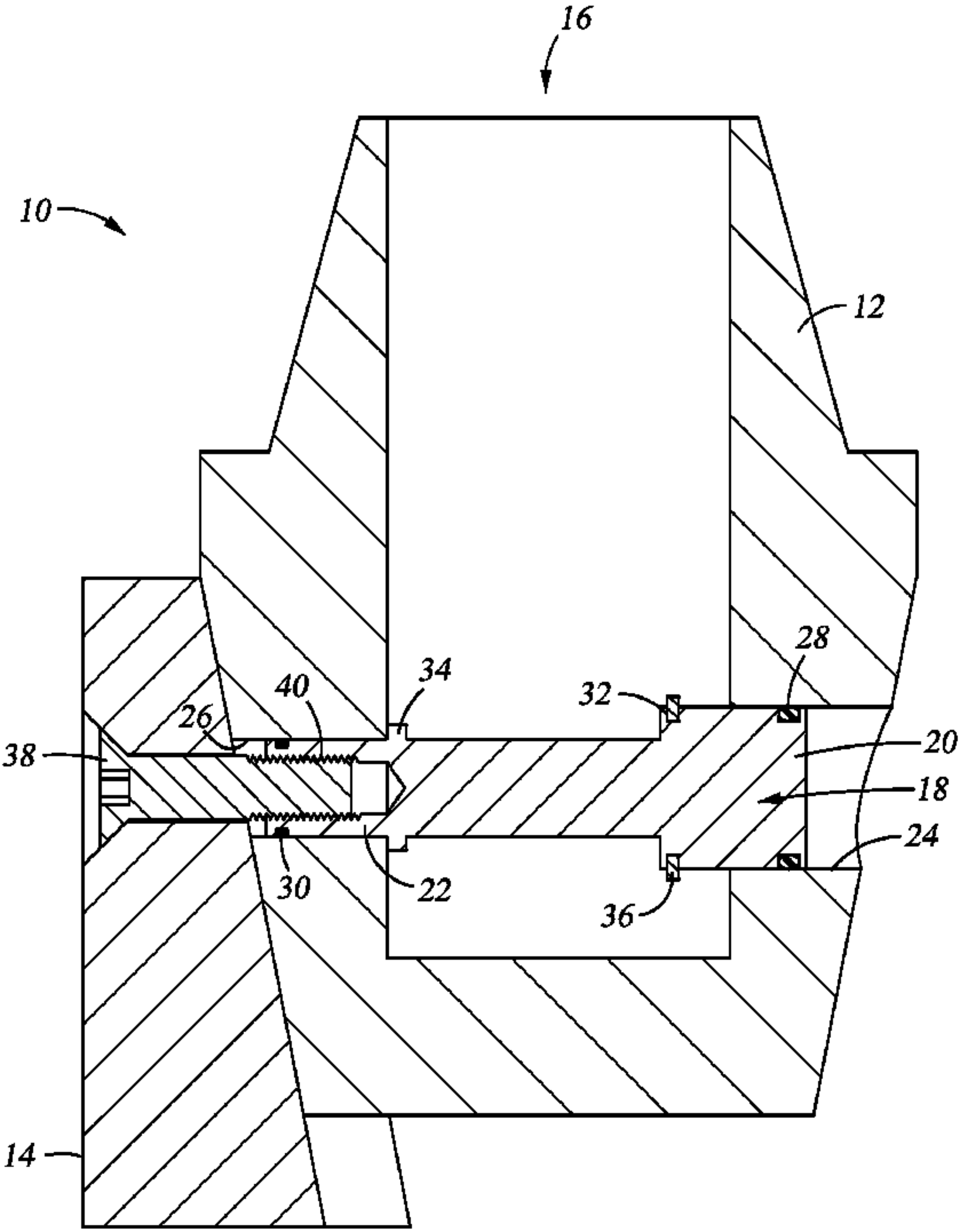


Fig. 1