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FORMATION PACKER

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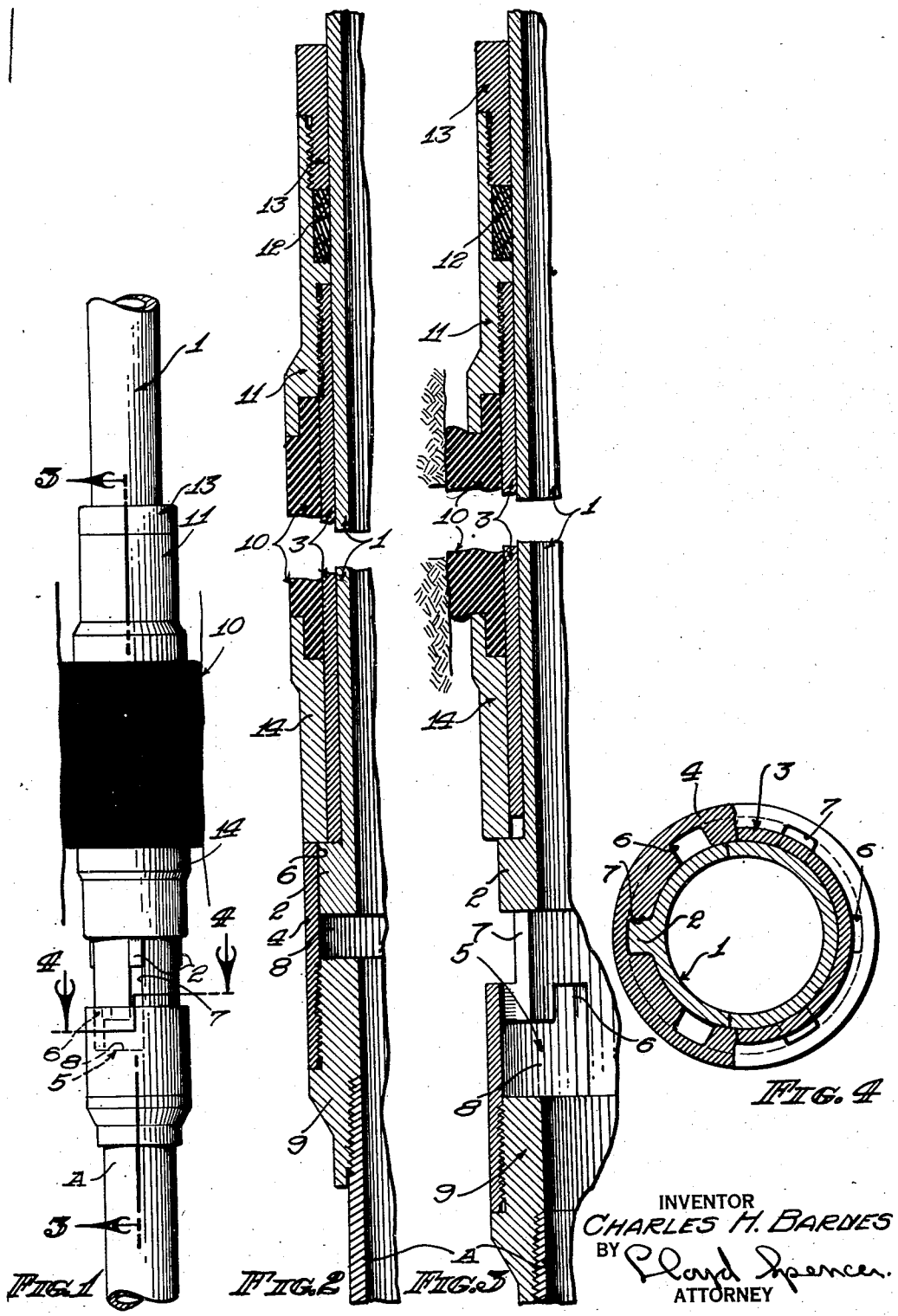


FIG. 1 FIG. 2 FIG. 3

FIG. 4

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FORMATION PACKER

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5 Claims. (Cl. 166—10)

My invention relates to formation packers; that is, to devices adapted to effect a seal between well tubing and surrounding formation confronting the well bore, and among the objects of my invention are:

First, to provide a formation packer which is particularly adapted to be interposed in a tubing string above a perforated liner to prevent downward flow of fluids around the tubing and into the liner;

Second, to provide a formation packer which does not require slips or similar wedging means, and is so arranged that when the packer is in position the liner below hangs in suspension, and its weight, in addition to any differential fluid pressure between the interior and exterior of the tubing string, insures ready engagement of the packer with the surrounding formation;

Third, to provide a formation packer which may be used with conventional liner hangers, or incorporated in tubing intended to be suspended from the well mouth; and

Fourth, to provide a bridging plug which is particularly simple and rugged in construction.

With the above and other objects in view, as may appear hereinafter, reference is directed to the accompanying drawing, in which:

Figure 1 is an elevational view of my formation packer as it appears when set within a well bore;

Figure 2 is an enlarged fragmentary sectional view of my formation packer, taken along the same line as Figure 3 but showing the parts in the positions assumed when running the packer into the well bore;

Figure 3 is an enlarged fragmentary longitudinal sectional view of my formation packer, taken through 3—3 of Figure 1, showing the parts in the positions assumed when the packer is in engagement with the surrounding formation; and

Figure 4 is an enlarged transverse sectional view through 4—4 of Figure 1.

My formation packer comprises two telescopically related tubular members including a mandrel 1 which is tubular in form and preferably equal in diameter to the tubing from which it is suspended. The lower end of the mandrel 1 is provided with radiating lugs 2. A sleeve 3 fits over the mandrel 1 and is enlarged internally at its lower end, as indicated by 4, to clear the lugs 2. The enlarged lower end 4 of the sleeve 3 is provided with J-slots 5, each comprising a short axial groove or leg 6 and a long axial groove or leg 7 connected by a cross groove 8. The lugs 2 are adapted to ride in the J-slots 5. The long grooves 7 extend above the enlarged lower end 4, so that when the lugs 2 move upwardly in the long grooves 7 they protrude radially from the sleeve 3.

The lower end of the sleeve 3 is attached by an adaptor fitting 9 to a liner A. The sleeve 3 carries a packing sleeve 10 formed of rubber or analogous material. The upper end of the packing sleeve 10 engages an abutment collar 11 which is screw-threaded to the upper end of the sleeve 10. The abutment collar 11 is provided with a packing gland 12 which forms a seal between the collar 11 and the mandrel 1. The packing gland 12 is provided with a packing gland nut 13 which is screw-threaded into the upper end of the abutment collar 11 around the mandrel 1.

Below the packing sleeve 10 there is provided a packer expanding collar 14. The packer expanding collar 14 is adapted to be engaged by the lugs 2 and moved upwardly on the sleeve 3 for the purpose of axially compressing and radially expanding the packing sleeve 10.

Operation of my formation packer is as follows: The packer is connected by the mandrel 1 to a tubing string (not shown) with a liner A suspended from the packer. The tubing string, packer and liner are lowered into a well bore until the liner engages the bottom thereof. In running into the well bore the lugs 2 fit into the short grooves 6 of the J-slot, as shown in Figure 2, thus preventing compression of the packing sleeve. When, however, the liner engages the bottom of the well bore the mandrel 1 may be moved downwardly and rotated to move the lugs 2 from the short groove 6 into the long groove 7, thereupon the tubing is raised which causes the lugs 2 to engage the packer expanding collar 14, forcing the packer out into contact with the walls. The only force actually available to expand the packer is the weight of the liner, which is transmitted through the packing sleeve 3 to the abutment collar 11. Consequently, it is possible, after the packing sleeve engages the well bore, to still lift the formation packer upwardly until the liner is spaced from the bottom of the well bore, preferably several feet. By moving the formation packer upwardly the frictional contact of the packing sleeve 10 with the formation tends to further compress the sleeve and insure a fluid-tight engagement with the surrounding formation.

It should be noted that the tubing string from which the packer is suspended may extend to the top of the well, or a liner hanger (not shown)

may be interposed in the tubing string, so that the tubing string may be attached to the casing above by means of the liner hanger and the remaining portion of the tubing string above the liner hanger removed. Once the formation packer is in place, and sealing against the formation, the difference in hydrostatic level between the interior of the tubing and the annular space around the tubing exerts a pressure tending to hold the packing element in sealing engagement.

I claim:

1. A formation packer comprising: a pair of relatively telescoping tubular members; a packing element carried on the outer of said members; and means for axially compressing and radially expanding said packing element, including means connected with said outer member forming an abutment for one end of said packing element and a collar slidable on the outer member and contacting the other end of the packing element, projections connected with the telescoping lower end of the inner member and extending radially through opening in the outer member for engagement with the collar to expand said packing element upon relative untelescoping movement of the tubular members.

2. A formation packer comprising: a pair of relatively telescopically related inner and outer tubular members; a packing element carried on the outer of said members; and means for axially compressing and radially expanding said packing element, including means connected with said outer member forming an abutment for one end of said packing element and a collar slidable on the outer member and contacting the other end of the packing element, lugs connected with the telescoping lower end of the inner member and extending radially through openings in the outer member for engagement with the collar to expand said packing element upon relative untelescoping movement of the tubular members; said outer member having J-shaped slots accommodating said lugs and having short legs adapted to restrain said lugs and long legs adapted to permit operation of said lugs.

3. A formation packer comprising: a mandrel; a sleeve slidably fitting thereover and having openings therein; a collar slidable on said sleeve; means on the telescoping lower end of said mandrel extending outwardly radially through the openings in said sleeve and engageable with the lower end of said collar to move the same; an abutment on said sleeve spaced from said collar; and a packing element on said sleeve between said abutment and said collar whereby, upon relative untelescoping movement of said sleeve and mandrel said packing element is axially compressed and radially expanded.

4. A construction, as set forth in claim 3 wherein said openings are J-shaped, forming a minor channel to accommodate said means and restrain untelescoping movement of said mandrel, and a major channel adapted to accommodate said means and permit untelescoping movement.

5. A formation packer comprising: a tubular sleeve attached to a liner and having slots in its lower end and an external abutment at its upper end; a mandrel suspended from a tubing string and slidably positioned within said sleeve and including lugs on its lower end extending radially through said slots; and a packing element interposed between said abutment and said lugs; a collar slidable on the sleeve and positioned between the packing element and the lugs whereby, upon movement of said sleeve downwardly on said mandrel, said packing element is axially compressed and radially expanded; said slots being J-shaped to form minor legs to restrain said lugs, and major legs to permit axial movement of said lugs.

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