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MULTIPLE RING PACKER

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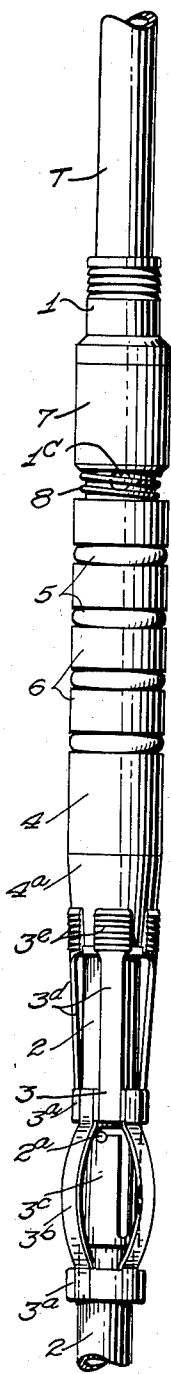


FIG. 1

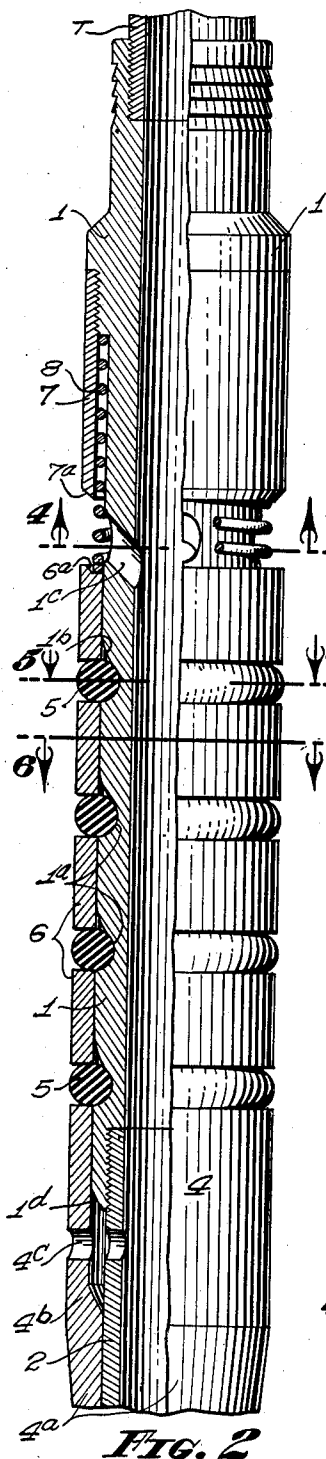


FIG. 2

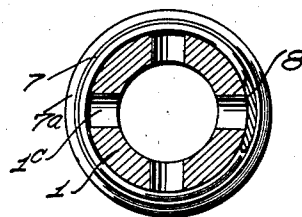


FIG. 4

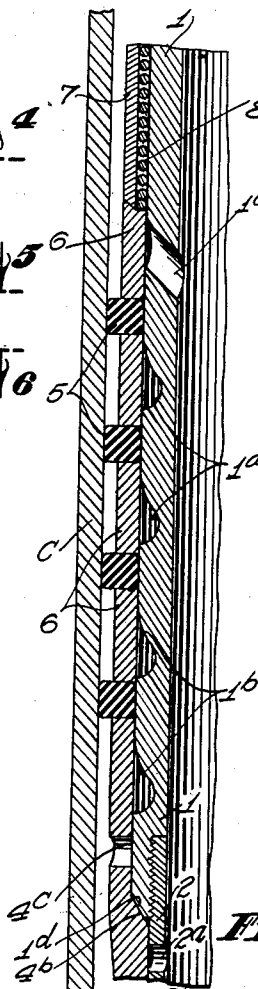


FIG. 3

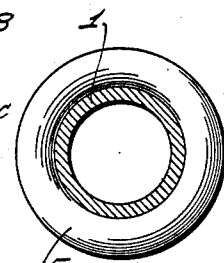


FIG. 5

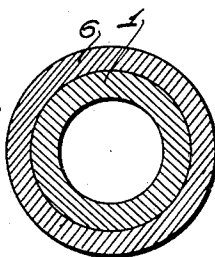


FIG. 6

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MULTIPLE RING PACKER

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11 Claims. (Cl. 166—12)

My invention relates to multiple ring packers for oil wells and the objects of my invention are:

First, to provide a multiple ring packer wherein by-pass passages are provided around the packing elements to facilitate flow of fluids through the packer as it is moved within a well bore; thereby providing a packer which may be readily and quickly raised or lowered even in a well bore filled with drilling mud or the like;

Second, to provide a packer of this character wherein abrasive wear on the packing rings is reduced to a minimum, the rings being shielded as the packer is raised or lowered and having only a minimum of sliding movement along the well bore while being forced to their operative or sealing positions.

Third, to provide a packer of this character, which, although adapted to by-pass fluids, provides a bore of maximum diameter therethrough so that tubing of relatively large diameter as compared to the well bore to be packed off may be used with the packer.

Fourth, to provide a packer which may be used repeatedly without renewal of the packing rings;

Fifth, to provide a packer wherein the parts are relatively few and easily fabricated.

With the above and other objects in view as may appear hereinafter attention is directed to the following specification and drawing, in which;

Figure 1 is an elevational view of my multiple ring packer in its inoperative position and attached to a tubing string.

Figure 2 is an enlarged fragmentary, partially elevational, partially sectional view of the packer showing the packing rings in their normal or inoperative position;

Figure 3 is a fragmentary sectional view of the packer similar to Figure 2, showing the packer in its set position.

Figure 4 is a transverse sectional view taken through 4—4 of Figure 2 showing the by-passing ports.

Figure 5 is another transverse sectional view through 5—5 of Figure 2 showing a packing ring in elevation.

Figure 6 is another transverse sectional view through 6—6 of Figure 2, showing one of the spacing rings.

A tubular body member 1 is provided which is internally threaded at its upper end for attachment to a tubing string T. The lower end of the body member is likewise internally threaded for attachment to an extension tube 2 which is in

turn connected to a perforated liner, or other device, not shown, below the packer.

The extension tube 2 receives a slip and cage assembly 3 of any suitable construction. In this case, the assembly 3 comprises a pair of slidable rings or collars 3a which are connected by spring bands 3b adapted to ride against the surrounding casing. The upper collar is provided with a sleeve, 3c, having a bayonet slot or slots which co-act with a pin, 2a, extending from the tube 2 to permit a limited sliding movement of the slip assembly. The upper collar supports a plurality of slip reins, 3d, the upper ends of which are attached to slips, 3e, having wickers on their outer sides.

The slips 3e are adapted to ride upon and be expanded by a frusto-conical lower portion 4a of a sleeve 4. Said lower portion 4a is slidable on the tube 2 while the upper portion of the sleeve is enlarged internally to fit over the lower end of the body member 1.

Beginning near the lower end of the body member is a series of annular channels 1a. Each channel receives a packing ring 5 formed of rubber or a composition of rubber and fabric and adapted to be expanded or stretched radially. The upper side of each channel forms an expanding cam means 1b for stretching the packing ring.

Approximately the radially outer half of each packing ring protrudes from its channel 1a. When the sleeve 4 occupies its lower position, its upper end is immediately below the lowermost packing ring. Between the protruding sides of the other packing rings are fitted spacer rings 6 in the form of short tubular sections. The uppermost spacer ring is provided at its upper edge with a valve seat 6a which is adapted to coact with a valve face 7a formed at the lower end of a depending ring valve 7. Said ring valve is attached as by screw threads to the upper portion of the body member 1 and forms therewith an annular, axially directed recess which receives a spring 8 the lower end of which bears against the uppermost spacer ring 6 within the valve seat 6a thereof.

The upper spacer ring 6 is normally spaced 45 downwardly from the ring valve 7 and opposite this space the body member 1 is provided with large by-passing ports 1c.

Operation of my packer is as follows:

The packer is lowered on a tubing string with 50 the slip assembly 3 held in an inoperative position by the pin 2a. When the desired level is reached, the tubing string is turned to release the slips, the spring bands 3b offering sufficient friction to permit this. The tubing string is then 55

lowered causing the slips 3e to wedge and secure the sleeve 4. Further downward movement of the tubing string causes the body 1 to move downward relative to the sleeve 4, packing rings 5 and spacer rings 6 and thereby force the packing rings 5 to expand to the position shown in Figure 3 and to press into sealing relation with the surrounding casing, designated C. This movement also closes the valve formed by the valve seat 6a and ring valve 7 and shuts off the by-pass ports 1c. The amount of compression applied to the packing rings by the spacer rings is limited by engagement of the lower end of the body 1 with a shoulder 4b formed within the sleeve 4.

The packer is released by raising the tubing string which draws upwardly on the body member 1 and permits the packing rings to contract back into their channels 1a.

In going into the well the fluid is free to flow upwardly within the extension tube 2 and body member 1 and out through the ports 1c which may be quite large. This is of particular advantage when it is desired to run the tubing string "dry"; that is, with a sealing device, not shown, located above the packer. For example, in making formation or casing shoe tests, it is necessary to run the tubing dry and to lower the packer through drilling mud. The comparatively large opening through the body member 1 and its ports 1c enables the packer to be thus raised or lowered with a minimum of resistance.

It should be noted that the several packing rings act as keys to retain the spacer rings in position so that it is impossible for the pressure from below to close the ports 1c regardless of whether or not the slip assembly holds the sleeve 4 down.

In addition to the valve seat 6a and valve face 1a the lower end of the body member 1 is provided with a valve face 1d which seats against a shoulder or valve seat 4b of the sleeve 4 when the packer is set as shown in Fig. 3. Above the seat 4b the sleeve is provided with ports 4c which register with ports 2a provided in extension tubing 2, when the packer is in position for raising or lowering as shown in Fig. 2. These ports are sealed from communication with each other by the valve face 1d and seat 4c when the packer is set as shown in Fig. 3.

I claim:

1. In a well packer; a series of packing rings and spacing rings arranged in alternate relation, said packing rings normally being less in diameter than said spacing rings and protected and held in fixed spaced relation thereby; a body member backing said rings; dilating means incorporated in the body member for expanding the packing rings radially beyond said spacing rings, said dilating means being in fixed relation with each other corresponding to the spacing of said packing rings and simultaneously engageable therewith; an annular valve means including an element incorporated in one of said spacing rings and an element associated with said body member, said body member defining a by-passing passage controlled by said valve means.

2. In a well packer: a plurality of spacer rings; packing rings positioned between and having a lesser initial internal diameter than said spacing rings; and a body member fitting within said rings having elements engageable simultaneously with said packing rings to expand said packing rings until their outer sides project radially beyond said spacer rings.

3. In a well packer: a body member having a

by-pass passage therethrough; valve means controlling said by-pass passage; a plurality of spacing elements surrounding said body member; a plurality of packing rings interposed between said spacing elements; and dilating elements incorporated in said body member and simultaneously engageable with the several packing elements to urge them radially outward.

4. In a well packer: a body member having a plurality of dilating elements incorporated therein; a plurality of spacer rings surrounding said body member; a plurality of packing rings interposed between said spacer rings and engageable with said dilating elements; and means for causing relative movement of said body member and said rings as a group whereby said dilating elements simultaneously expand said packing rings.

5. In a well packer: a sleeve; a slip assembly adapted to be released within a well bore to restrain said sleeve against axial movement; a series of packing rings and spacing rings arranged alternately and supported by said sleeve; a body member adapted to fit within said rings and sleeve and movable axially with respect thereto; and dilating means incorporated in said body member and engageable with said packing rings simultaneously to urge them radially outward upon such axial movement of said body member.

6. In a well packer: a plurality of spacer rings; packing rings positioned between and having a lesser initial internal diameter than said spacing rings; a body member fitting within said rings having elements engageable simultaneously with said packing rings to expand said packing rings until their outer sides project radially beyond said spacer rings, said body member being hollow, extending beyond said rings, and having ports communicating through its side walls; and valve elements incorporated in said body member and one of said spacer rings, said valve elements adapted to seal said ports upon movement of said dilator elements in a manner to expand said packing rings.

7. In a well packer: a body member having a plurality of dilating elements incorporated therein; a plurality of spacer rings surrounding said body member; a plurality of packing rings interposed between said spacer rings and engageable with said dilating elements; means for causing relative movement of said body member and said rings as a group whereby said dilating elements simultaneously expand said packing rings, said body member being hollow, extending beyond said rings, and having ports communicating through its side walls; and valve elements incorporated in said body member and one of said spacer rings, said valve elements adapted to seal said ports upon movement of said dilator elements in a manner to expand said packing rings.

8. In a well packer: a sleeve; a slip assembly adapted to be released within a well bore to restrain said sleeve against axial movement; a series of packing rings and spacing rings arranged alternately and supported by said sleeve; a body member adapted to fit within said rings and sleeve and movable axially with respect thereto; dilating means incorporated in said body member and engageable with said packing rings simultaneously to urge them radially outward upon such axial movement of said body member, said body member being hollow, extending beyond said rings, and having ports communicating through its side walls; and valve elements incorporated in said body member and one of said spacer rings, said valve elements adapted

to seal said ports upon movement of said dilator elements in a manner to expand said packing rings.

5 9. In a well packer; a body member having a by-pass passage therethrough; valve means controlling said by-pass passage; a plurality of expansible rings; means for retaining said rings in a predetermined axially spaced relation; and expanding elements bearing a fixed relationship
10 with each other corresponding to the spacing of said rings and movable to expand said rings simultaneously.

15 10. In a well packer: a packing ring supporting structure; a plurality of packing rings retained in fixed spaced relation with each other by said structure; and dilating means arranged

to pass within said structure including dilating elements occupying a fixed spaced relationship corresponding to the spacing of said packing rings and engageable with said packing rings in unison to expand the same radially.

5 11. In a well packer: a series of packing rings and spacing rings arranged in alternate relation, said rings normally being less than the diameter of said spacing rings and protected thereby; a
10 body member backing said rings; and dilating means associated with said body member and including dilating elements occupying a fixed relationship corresponding to the spacing of said
15 packing rings for expanding simultaneously the packing rings radially beyond said spacing rings.

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