June 28, 1949. A. J. PENICK 2,474,491

PACKER FOR WELLS

Filed Oct. 20, 1944 2 Sheets-Sheet 1

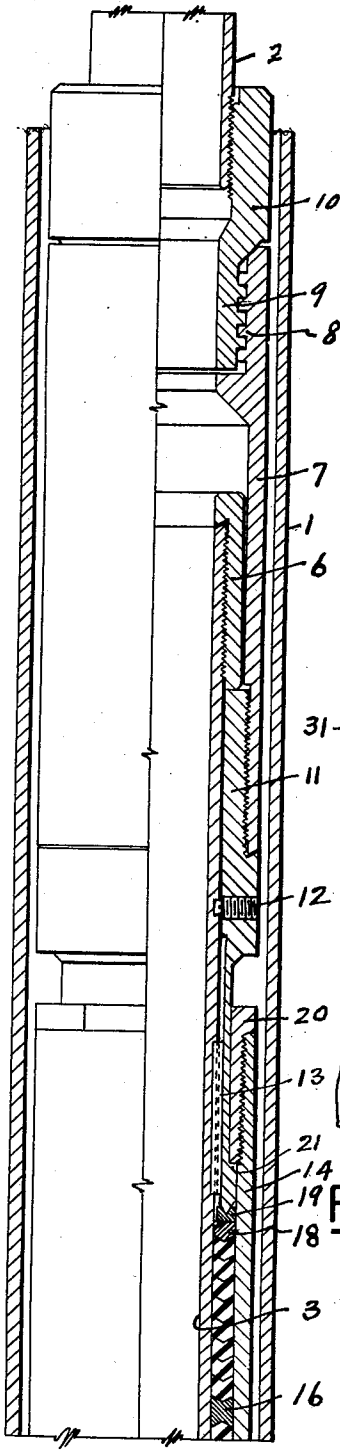


Fig. 1.

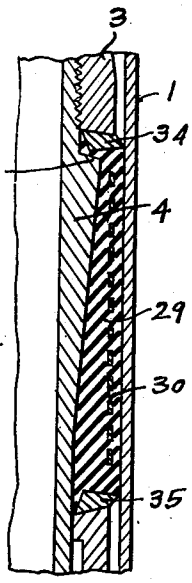


Fig. 3.

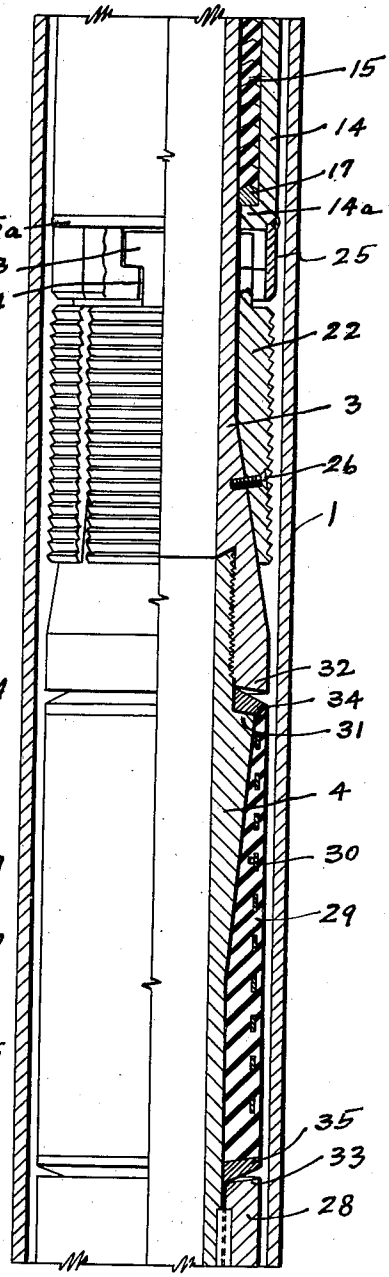


Fig. 2.

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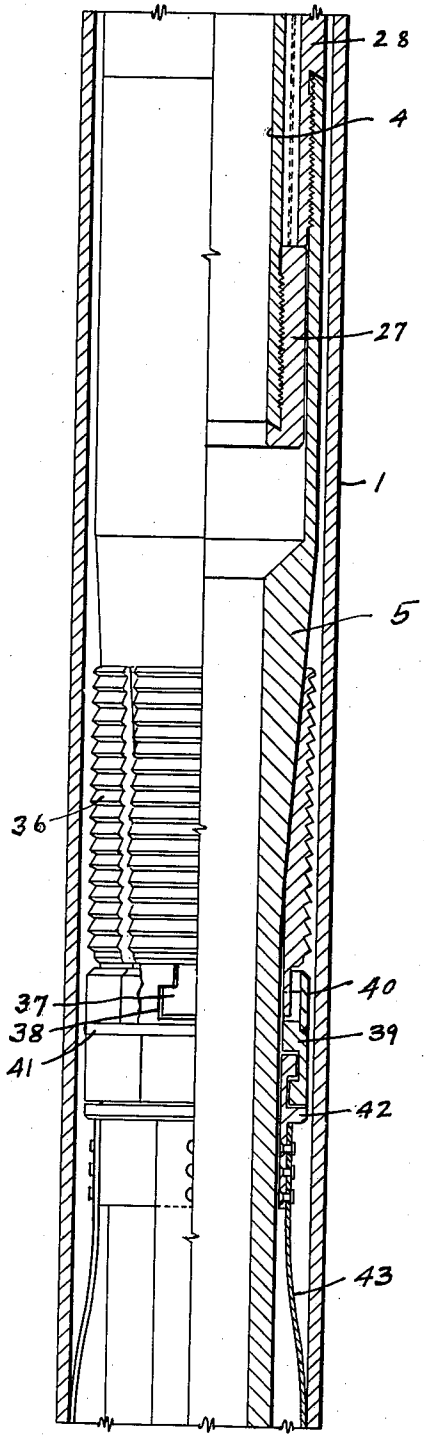


Fig. 4.

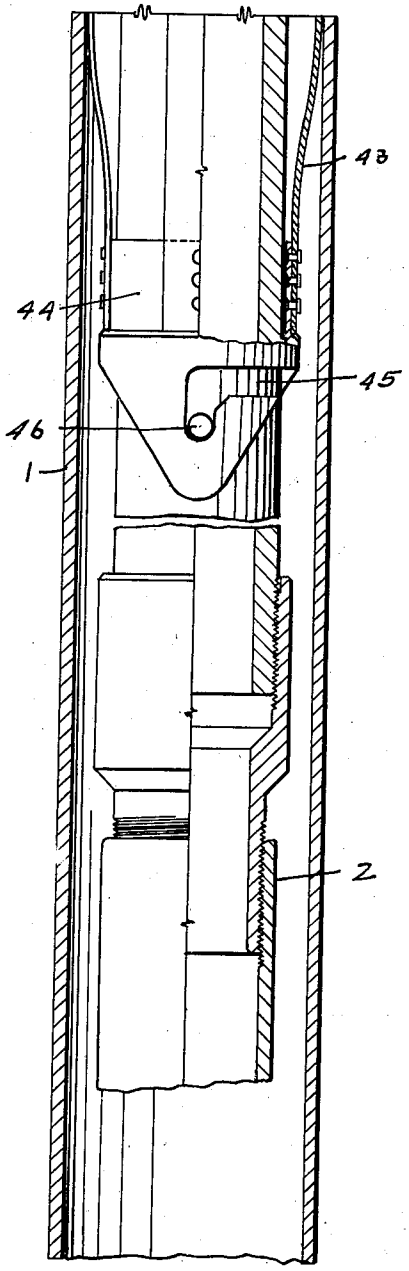


Fig. 5.

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PACKER FOR WELLS

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5 Claims. (Cl. 166—12)

1

This invention relates to a packer for wells.

An object of the invention is to provide means for forming a seal between an outer pipe, or casing, set in a well bore and an inner pipe, or tubing, in the casing.

Another object of the invention is to provide a novel type of sleeve like packing element with upper and lower sets of slips to hold said element expanded against the casing with novel means for retaining the packing element to prevent it from flowing when subjected to endwise compression.

With the above and other objects in view the invention has particular relation to certain novel features of construction, arrangement of parts and use, an example of which is given in this specification and illustrated in the accompanying drawings, wherein:

Figure 1 is a vertical, sectional view of the upper end of the assembly.

Figure 2 is a vertical, sectional view of an intermediate portion of the assembly showing the packer element contracted.

Figure 3 is a fragmentary, vertical, sectional view showing the packer element expanded.

Figure 4 is a vertical, sectional view of an intermediate portion of the assembly; and

Figure 5 is a vertical, sectional view of the lower end thereof.

Figures 1, 2, 4 and 5 show the complete assembly with the packer element collapsed and the views being consecutive sections of the assembly from above downwardly.

Referring more particularly to the drawings the numeral 1 designates an outer pipe, or casing, set in a well bore and the numeral 2 designates the inner pipe, or tubing.

Connected into the inner pipe there is the upper expander 3 whose lower end is, externally, tapered upwardly, the intermediate expander 4 whose upper end is, externally, tapered downwardly and the lower expander 5 having an intermediate portion which is tapered downwardly, externally. The expanders 3 and 4 are screwed together, as shown in Figure 2 and the upper end of the expander 3 is extended upwardly and screwed onto the upper end thereof there is an external collar 6.

There is an elongated coupling 7 whose upper end is inwardly thickened and formed with coarse threads 8 into which the coarse external threads of the pin 9 of the coupling 10 are screwed. This coupling 10 is connected to the portion of the tubing 2 above.

The expanders 3, 4 and 5, the collar 6, the

2

couplings 7 and 10 and the collar 27 hereinafter referred to, together with the packers 15 and 29 constitute what may be termed the packer assembly which is connected into the inner pipe 2.

There is a tubular nipple 11 onto the upper end of which the coupling 7 is screwed and this nipple is connected to the upper end of the expander 3 by means of a shearable pin 12 with the upper end of the nipple in abutting relation with the lower end of the collar 6. The nipple 11 has a splined connection with the expander 3 by means of the key 13.

There is a tubular packing retainer 14 around and spaced from the upper portion of the expander 3 and the lower end of this packing retainer is formed with the inwardly turned flange 14a which closely surrounds the upper expander 3, and supported on the flange 14a is suitable packing 15 formed of the upper and lower series of packing rings with a metal ring 16 between them. The packing 15 also includes a lower metal ring 17 on the flange 14a and the upper metal ring 18. Supported on the metal ring 18 is the V-shaped metal ring 19 into which the lower end of the nipple 11 fits.

Screwed into the upper end of the packing retainer 14 there is a gland 20 whose lower end abuts the outside, annular shoulder 21 on the nipple 11 to prevent detachment of the nipple from the packing retainer upon upward movement of the inner string.

There is a series of casing engaging slips 22 around the expander 3 and whose lower ends are tapered to conform to the tapered portion of said expander. The upper ends of the slips 22 have dovetailed extensions 23 which are fitted into correspondingly shaped slots 24 in a surrounding band 25. This band is formed of sections and is welded to the lower end of the packing retainer 14 by the weld 25a. At least one of the slips 22 is pinned to the expander 3 by the shearable pin 26 so as to hold said slips retracted, or in inactive position, while the packer assembly is being lowered.

Screwed onto the lower end of the intermediate expander 4 there is an external collar 27, and surrounding the lower end of the expander 4 with its lower end abutting said collar 27 there is a nipple 28 which has a splined connection with the intermediate expander 4, and the upper end of the lower expander 5 is screwed onto the lower end of this nipple 28.

A sleeve like packer 29 surrounds the expander 4. It may be formed of rubber or similar expansible material and has a plurality of metal

bands, or rings 30, embedded therein; or instead of these rings the reinforcement may be formed of a continuous spiral formed of metal.

As shown in Figures 2 and 3 the expander 4 has an upwardly facing external shoulder 31 which is spaced from the opposing lower end of the upper expander 3 which lower end forms a downwardly facing shoulder 32. The extreme upper end of the nipple 28 forms an upwardly facing shoulder 33.

Between the shoulders 31 and 32 there is a ring 34 and between the shoulder 33 and the opposing end of the packing sleeve 29 there is a ring 35. The upper and lower sides of the respective rings 34 and 35 taper, or converge, outwardly as shown in Figure 2. These rings 34 and 35 are preferably formed of brass or other metal which will yield under pressure and they abut the upper and lower ends of the packing sleeve as shown. In other words the rings 34, 35 are dished or generally convexo-concave in shape and when the resilient packer element 29 is expanded as hereinafter explained, the rings 34, 35 are deformed, bending or tilting about the inner edge of each ring remote from the packer and spreading outwardly of the outer periphery of the tool and bridging the space between the tool and the inner wall of the casing.

Around the lower expander 5 are the slips 36 whose inner sides are tapered to conform to the taper of said expander. The lower ends of these slips have dovetailed extensions 37 which are fitted into corresponding shaped slots 38 in the swiveling ring 39. They are retained therein by the surrounding band 40 which is welded to the ring 39 by the weld 41. The ring 39 has a swiveling connection with a complemental ring 42 as shown in Figure 4 and the upper ends of the outwardly bowed wiper springs 43 are fastened to the ring 42 while their lower ends are fastened to the lower ring 44, said rings surrounding the tubular extension of the expander 5, as shown in Figures 4 and 5.

The lower ring 44 has a transverse J-slot 45 whose inner end has a downwardly extended notch in which the pin 46 is seated. This pin may be screwed into said tubular downward extension of the expander 5.

The packer assembly may be assembled as shown in Figures 1, 2, 4 and 5 and lowered into the casing to the desired point at which it is desired to set the packer. The inner string may then be elevated and turned to the left to unseat the pin 46 from the J-slot and the inner string then lowered. The wiper springs 43 will hold the slips 36 against further downward movement and as the expander 5 moves downwardly the slips will be moved outwardly and their external teeth will engage the casing and will stop the downward movement of the expander 5. Upon further downward movement of the inner string the expanders 3 and 4 will be moved further downwardly thus applying a compressive force to the packer 29 to cause its expansion. This compressive force will spread the rings 34, 35, moving the upper ring upwardly and outwardly and the lower ring downwardly and outwardly into the position shown in Figure 3 so that they will bridge the space between the packer assembly and the outer casing and effectively prevent the packer 29 from flowing upwardly and downwardly between the inner assembly and the outer casing as clearly indicated in Figure 3. It may be here stated that the sleeve like packer 29 may be made of lead or other soft material. Additional weight

of the inner pipe 2 above will now shear the pin 12 and the nipple 11 will move on downwardly shearing the pin 26 and causing the slips 22 to move downwardly into engagement with the outer casing and the external teeth on said slips will engage with the casing and maintain the packer 29 in expanded position.

The additional weight on the inner pipe 2 will expand the packing 15 and maintain the same expanded so as to form a fluid tight seal around the tubular upwardly extended end of the expander 3. This will prevent the fluid flowing upwardly through the inner pipe from finding its way into the space between the inner pipe and the outer casing 1.

If it should be desired to release the packing the inner pipe, and packer assembly, may be pulled upwardly and turned to the right and the pin 46 re-engaged in the J-slot 45 and the packer 29 thus relieved from the compressive force and the assembly may be elevated or lowered in the casing and reset, the collar 6 hanging on the upper end of the nipple 11 while the packing assembly is being elevated or lowered.

If for any reason the packer cannot be released the pipe 2 may be turned to the left and the coarse threads connecting the upper portion of the pipe to the coupling 7 unscrewed and that portion of the inner pipe above may then be withdrawn from the well.

What I claim is:

1. In a packer assembly adapted to be lowered into a casing in a well, two tubular telescoping parts movable axially relative to each other and forming a packer support, a resilient, expansible, sleeve-like packer around one of said parts, annular substantially transverse, shoulders on the respective parts spaced from the corresponding ends of the packer, a dished ring of pliant, malleable material around said support between each shoulder and the adjacent end of the packer, the upper and lower surfaces of each ring converging outwardly with respect to the corresponding surfaces of the other ring thus providing annular, outwardly flared, spaces between said rings and the adjacent shoulders, said shoulders being movable toward each other to apply endwise compressive force to the packer to expand the packer, said rings being tiltable about their inner margins, in response to said force, and deformable to bridge the space between the packer support and casing.

2. Means for forming a seal between an outer well casing and an inner string of pipe in the casing comprising, a resilient expansible, non-metallic, sleeve like packer supported by the inner string, annular shoulders on the inner string adjacent the respective ends of the packer for applying an endwise compressive force to said packer to expand the same against the casing and upper and lower rings, convexo-concave in shape, at the ends of the packer which are formed of pliant, malleable, non-resilient material and which converge outwardly, the outer margin of said upper ring being movable upwardly and outwardly and the outer margin of the lower ring being movable downwardly and outwardly, upon application of said compressive force, to bridge the space between the inner string of pipe and outer casing to prevent the endwise flow of the packer.

3. A packer for wells for forming a seal between an outer casing in the well and an inner pipe in the casing comprising, telescopically arranged parts connected to the inner pipe, a resilient, ex-

pansible sleeve-like packer around one of said parts, external, annular, substantially transverse, abutments on the respective parts adjacent the respective ends of the packer, pliant, malleable, rings of non-resilient material around the parts between the ends of the packer and the corresponding abutments, the upper and lower surfaces of said rings converging outwardly and thus providing annular outwardly flared spaces between the rings and corresponding abutments, said abutments forming means for applying an endwise compressive force to the packer, upon relative longitudinal movement of said parts in one direction, to expand the packer against said casing and said rings being tiltable, in response to said force, against said abutments, and being also expansible to allow their outer margins to move, in response to said force, across and to close, the space between the tubing assembly and said casing.

4. A packer for wells for forming a seal between an outer casing in the well and an inner pipe in the casing comprising, telescopically arranged parts connected to the pipe, a resilient expansible sleeve-like packer around one of said parts, external, annular, substantially transverse, abutments on the respective parts adjacent the respective ends of the packer, pliant, malleable, rings of non-resilient material around the parts between the ends of the packer and the corresponding abutments whose upper and lower surfaces converge outwardly with annular outwardly flared spaces between the rings and corresponding abutments, said abutments forming means for applying an endwise compressive force to the packer, upon relative longitudinal movement of said parts in one direction, to expand the packer against said casing, said rings being tiltable, in response to said force, against said abutments with their outer margins across the space between the tubing assembly and said casing to prevent flowing of the packer.

5. A packer means for forming a seal between an outer well casing and an inner string of pipe in a casing including, an annular expansible sleeve-like packing element supported by the inner string, an annular external shoulder on said inner string adjacent each end of the packing element, one of said shoulders being slidable on the inner string for applying an endwise compressive force to the packing element to expand the outer surface of the same radially outwardly against the casing, and a deformable ring member surrounding the inner pipe string and interposed between each end of the packing element and the shoulder adjacent to the end, each ring having one surface engaging the end of the packing element and having its opposite surface, which is contiguous to the adjacent annular shoulder, initially disposed at an acute angle with respect to said shoulder whereby the outer marginal portion of each ring is tiltable toward the shoulder and outwardly toward the well casing upon the application of a compressive force to the packing element, whereby said rings bridge the space between the inner string of pipe and the outer casing to prevent endwise flow of the packing element.

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