



# UNITED STATES PATENT OFFICE

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## RAT-HOLE PACKER

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2 Claims. (Cl. 166-10)

The present invention is an improved rat-hole or liner type packer for use in wells which have been bored to a given depth and thereafter continued in depth with a drill of smaller diameter to form a shoulder for the support of a packer or a liner hanger.

Attention is called to my co-pending application for Letters Patent Serial No. 620,637 filed July 2, 1932 covering packer.

In the present application applicant seeks to cover by the appended claims, the features of novelty heretofore found allowable in above said application, insofar as they are applicable to a packer of the type herein described.

The objects of this invention include:—

The provision of a packer for the uses specified, wherein is provided a central by-pass extending thru the packing elements, and affording means for fluid passage therethrough, said packer being a separable structure provided with yieldable means for holding the separable parts apart as the device is run in through dense drilling mud commonly employed in rotary drilling.

The provision in a rat-hole packer wherein a central by-pass extending therethrough is closed by compressive force applied to head and foot members, one of which is secured to, and the other slidable on, a tubing string, of a secondary valve controlling a bleeder passage which communicates with said by-pass.

The purpose of said secondary valve is to facilitate the release of the packer after having been set.

In the structure hereinafter described the first upward movement of the tubing string, before actual lifting strain is applied to pull the packer, is effective to open said by-pass, and cause a sudden equalization of hydrostatic pressure above and below the packing element.

Field experience shows that fewer units of weight are recorded on the weight indicator of the derrick rig when the packer is lifted in this manner.

By breaking the hydraulic lock at the bottom by the use of my bleeder valve, much less strain is imposed on the elevator. This is an important advantage of my invention which makes its use of advantage in deep wells wherein long heavy strings of tubing are run in and out thru dense drilling mud. It also makes certain the removal of a packer under extreme pressure conditions and eliminates the necessity of lifting the entire area against the resistance of heavy rotary mud.

In the accompanying drawing, Figure 1 is a vertical cross sectional view of my packer as it

would appear at rest upon the shoulder of the rat-hole in open formation before weight of the tubing string, from which it is suspended, had been applied to deform the packing elements.

Figure 2 is a similar view of the same packer, in set position, but here shown as employed to pack around a well casing shoe, said packer resting on a liner hanger of conventional type.

Figure 3 is a section of Figure 1 taken on the dotted line III—III of said figure.

Figure 4 is a section of Figure 1 taken on the line IV—IV of said figure, and

Figure 5 is a sectional view of a modified detail.

Referring to the drawing, the numeral 1 indicates the lowermost member of a tubing string from which my packer is suspended. Tubing 1 is threaded at 2 to engage a collar 3. A slip head member 4 is slidable on tubing 1, and over collar 3, and is provided with an annular groove 6 which is of V shape in cross-section.

Sliphead 4 is provided with quadrilaterally disposed ports 8 affording means for fluid communication from the outside to a chamber 9 and groove 6. Passages 11 connect groove 6 with a by-pass in a foot member 13 when said foot member and the head 4 are compressed as shown in Figure 2.

Groove 6 is closed and passages 11 sealed in this position by an annular tongue member 14 integral with collar 3.

A pointed tube 16 provided with perforations 17 is threaded at 18 into the head 4 and conducts fluid from the zone below the packer thru a chamber 19 in said head to the tubing string 1.

A collar 21 secured to tube 16 supports the foot member 13 and said foot member and the head 4 are normally held apart as the packer is run in, by an expansion spring 22, one end of which bears against said head, and the other end against lugs 23, Figure 4, integral with said foot member.

Said lugs also serve to align said foot member with tube 16 upon which it slides.

Foot member 13 is here shown as built up of a series of laminated sheets A and B of woven or reinforced material, such as belting, adapted to be deformed by compression between the head 4 and foot 13 and thereby seal the well or casing, as the case may be, against passage of fluid there-through, as shown in Figure 2.

Here the foot member 13 is shown in deformed position, being compressed by weight of tubing string 1. Said weight is transmitted thru collar 3 which bears against groove 6 closing same, and this pressure collapses spring 22, causing head 4 to contact the upper surface of foot 13, de-

forming the laminated packing A and B and setting the packer.

In Figure 2, foot member 13 rests on a liner hanger 26 from which is suspended a liner 27.

5 In that type of well shown in Figure 1 said foot member rests on a shoulder 28 of formation.

#### Operation

10 My packer is run in a well on a tubing string 1 until the foot member 13 encounters an obstruction at the bottom (shoulder 28 or liner hanger 26). As the packer is being lowered thru dense drilling mud or other fluid, spring 22 holds head 4 and foot 13 out of contact, and the mud is displaced through by-pass 12 and out between said members.

20 As soon as foot member 13 is interrupted in its travel, the descending tubing string moves collar 3 downwardly until tongue 14 closes groove 6 in the head 4, and the weight of said tubing string collapses spring 22, bringing head 4 and foot 13 into contact, closing by-pass 12 and deforming the packing elements A—B, and setting the packer.

25 When it is desired to remove the packer the tubing string is raised, and the first upward movement thereof lifts collar 3, uncovering ports 8, whereupon hydrostatic pressure in the well zone above the packer passes thru said ports 8, thru passages 11, and thru by-pass 12 to the zone below the packer.

30 The suddenness of this operation produces an impact of sufficient force to jar the packer loose, and relieve the elevating rig from undue strain of hydraulic lock.

35 This fact has been clearly demonstrated by the weight indicator on the derrick. During early experiments this bleeding of the by-pass was accomplished by dropping a go-devil from the top thru the tubing string.

40 Before this was done a lifting force more than sufficient to lift the suspended string but not enough to dislodge the packer was applied to the tubing string. A reading was taken from the weight indicator dial and recorded.

45 The bleeder was then opened by dropping a weight, and lifting strain again applied. The packer and tubing string was then removed with a lifting power the maximum of which was much less in amount than that of the previously recorded reading.

50 In addition to this gauge reading, visual proof was afforded by the fact that at the instant the go-devil struck, the pipe string surged upward and offered no resistance, other than dead weight, to its removal.

55 In Figure 5 I show an elongated form of the slip head 4 in which the ports 8 are disposed in helical arrangement therethrough and their number increased, and more room is provided for movement within said head of the collar 3.

This structure provides a means for throttling the capacity of the ports 8 by positioning the said collar. This makes it possible to equalize pressure above and below the packer, either gradually or suddenly as heretofore described.

Another instance of the advantage of this structure is manifest in the removal of gas accumulation in the zone below the packer.

8 While the primary valve (contact between head 4 and foot 13) is closed, collar 3 can be lifted to uncover as many of ports 8 as are required to accommodate the gas flow and relieve said pressure accumulation.

I claim:—

9 1. A device of the character disclosed, comprising a pair of sections of tubing joined in an end-to-end relation in a manner providing a limited degree of relative movement, a packing element, slidable on the lower of said sections, adapted, when deformed, to seal the space between said section and an adjacent wall, said element having a by-pass channel therethrough, connecting the zones above and below said packing, outside of and independent of said tubing, a head member secured to said lower section and slidable with respect to the upper of said sections, having ports therethrough adapted to register with the by-pass channel thru said packing element, means, responsive to weight of the upper tubing section, for actuating said head member to deform said packing element and close said by-pass, means, responsive to movement of said upper section for selectively opening and closing said ports while said by-pass is closed by said head member, and means, yieldable to the weight of said upper tubing section, holding said head member and said packing element apart, and said by-pass open, while the device is being raised or lowered.

11 2. A packer of the character disclosed comprising a sectional tubing string, wherein sections are joined in end-to-end relation by slip-joint structure permitting a limited degree of relative movement of said sections, a packing element constituting a foot member slidably supported on the lower of said sections, provided with a flow channel therethrough, outside of said tubing section, a head member secured to said lower section and slidable with respect to said upper section, adapted, when depressed, to deform said packing element and to close said flow channel, said head member having ports connecting the flow channel through said packing element with the well cavity above said packing element, a closure, associated with the upper of said tubing sections, adapted to open and close said ports when said upper section is reciprocated, and an expansion spring urging said head member and said packing element apart and keeping said flow channel open.

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