Feb. 15, 1949. D. C. MARLER 2,461,650

WELL PACKER

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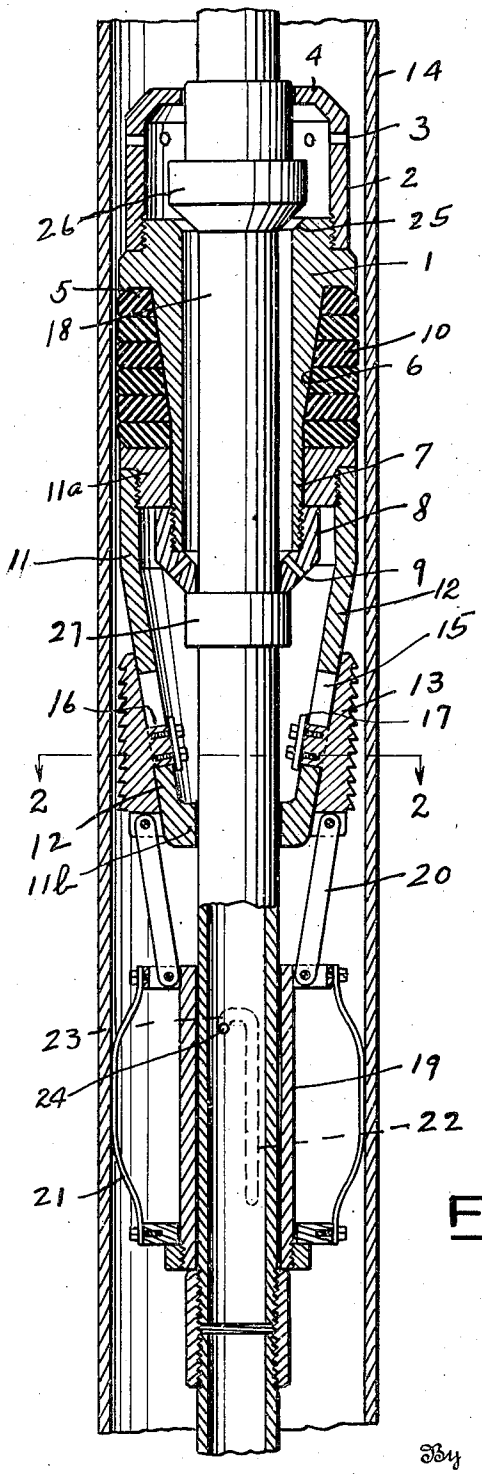


Fig. 1.

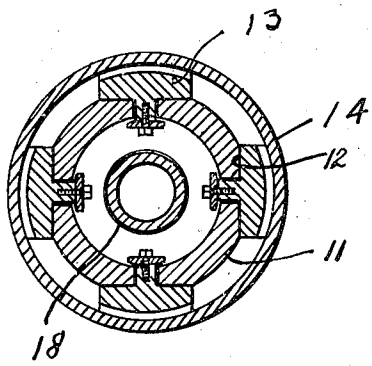


Fig. 2.

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WELL PACKER

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1 Claim. (Cl. 166—12)

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This invention relates to a well packer.

An object of the invention is to provide a packer of the character described for forming a fluid tight seal between an outer pipe and an inner pipe in a well bore.

Another object of the invention is to provide novel means, including a tapering expander, for expanding the packing element so as to form a contact between the entire external area of the element and the outer pipe.

In a preferred form of the invention the packing element will be formed of a series of adjacent packing rings surrounding a tapering mandrel with means for holding the packing element stationary while the mandrel is forced downwardly to secure a uniform expansion of the packing element from end to end thereof.

It is another object of the invention to provide novel means for withdrawing the packer from the well if desired.

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

Figure 1 shows a vertical sectional view of the packer showing the packing element collapsed; and

Figure 2 shows a cross, sectional view taken on the line 2—2 of Figure 1 and showing the parts in positon when the packing element is expanded.

Referring now more particularly to the drawings, wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates a mandrel whose upper end is externally threaded to receive the safety cap 2 which is provided with the perforations 3 and with the inwardly extended annular flange 4.

The mandrel is also provided with an external downwardly facing shoulder 5 and beneath said shoulder with the external downwardly tapering portion 6 and the mandrel terminates at its lower end in the straight portion 7.

Screwed onto the lower end of the mandrel there is the annular stop 8 which is provided with a plurality of ducts 9 for the free circulation of fluid therethrough.

Surrounding the mandrel beneath the shoulder 5 there is an expansible packing element which is preferably formed of a series of expansible packing rings 10. The outer surface of the packing element is approximately cylindrical and its inner surface is shaped to conform to the contour of the external surface of the mandrel.

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There is a shell-like jaw expander 11 having a plurality of external downwardly converging faces 12. There are preferably three of these faces 12 although a greater or less number may be provided. Slidably mounted on these faces are the wedge shaped jaws 13 adapted, when expanded, to engage with the inside surface of the outer pipe 14.

The jaws are mounted to move on the faces 12 in any preferred manner. Preferably the expander 11 is provided with the vertical slots 15 and the jaws have inward extensions 16 through said slots with retainer plates 17 bolted onto the inner ends of said extensions.

The numeral 18 designates the inner pipe. This pipe extends downwardly through the cap 2, the mandrel 1, the stop 8 and the expander 11 and slidably mounted on the inner pipe beneath said expander there is the sleeve 19. The upper end of this sleeve is connected to the respective jaws 13 by the links 20 which are pivoted to the jaws and to said sleeve. Mounted on the sleeve 19 are the outwardly bowed wiper springs 21 which are in constant frictional engagement with the outer pipe 14.

The sleeve 19 has an inverted J-slot 22 whose upper end is overturned and formed with the notch 23 and the inner pipe 18 has an outwardly extended stud 24 which may be seated in said notch and which, when so seated, holds the sleeve 19 in its lower position on the inner pipe so as to maintain the jaws 13 in their lower position and thus retracted from the outer pipe.

The packer may be assembled and let down into the well as shown in Figure 1. As it is lowered the liquid in the well may freely flow up around the packer and may pass through the ducts 9 and up through the mandrel and out through the perforations 3. When the point has been reached at which it is desired to expand the packer the inner pipe 18 may be slightly elevated to unseat the stud 24 from the notch 23 and then turned to the right. The sleeve 19 will be held stationary by the springs 21 during this movement. The inner pipe 18 may then be lowered, the stud 24 moving along the slot 22.

The upper end of the mandrel 1 has an inside tapering seat 25 and the inner pipe 18 has an enlarged coupling 26 which is located above said seat and whose lower end is tapered. Upon this downward movement of the inner pipe the tapered lower end of the coupling 26 will land on the seat 25 and close the passageway through the mandrel and force the mandrel 1, the packer 10 and the expander 11 downwardly but the jaws

13 will be held against downward movement and will, therefore, be expanded, by said expander into engagement with the outer pipe and this will stop the downward movement of the expander.

As clearly shown in the drawings the upper and lower ends of the jaw expander have the inwardly extended flanges 11*a* and 11*b* the former of which surrounds the lower end of the mandrel 1 and the latter of which surrounds the inner pipe. The flange 11*a* is located above the stop 8 and the packing element 10 rests on it so that upon the further downward movement of the inner pipe 18 the mandrel 1 will be moved on downwardly, the shoulder 5 applying a compressive force to the packing element 10 and the tapering portion 6 of the mandrel will apply an expansive force to said packing element thus forming a seal with the outer pipe throughout the entire external area of the packing element.

Should it be desired to withdraw the packer from the well an upward pull may be taken on the inner pipe 18 and upon upward movement thereof the coupling 27 will engage the lower end of the stop 8 and move the same, together with the mandrel, upwardly thus relieving the expansion on the packing element and said stop will eventually engage the flange 11*a* and elevate the jaw expander thus releasing the jaws 13 from the outer pipe so that the packer may be removed from the well. As the packer moves upwardly the liquid in the well can flow freely through the perforations 3 and ducts 9 thus relieving the load of the liquid column above.

The flange 4 of the cap 2 overhangs the upper end of the coupling 26. In the event the inner pipe 18 should become broken-off beneath the coupling 26 upon withdrawal of said inner string said coupling 26 will engage the flange of the cap 2 and the packer may thus be withdrawn. This safety provision has been made due to the fact that at the present time packers are often left in the well due to breakage of the inner pipe.

The perforated cap 2 above and the stop 8, with its ducts, beneath, form strainers to exclude detritus, and clogging material from the interior of the packer mechanism.

The drawings and description are illustrative merely while the broad principle of the invention will be defined by the appended claim.

What I claim is:

A packer adapted to form a seal between an outer pipe and an inner pipe in a well and comprising a tubular mandrel, an inner pipe section working through, and spaced from, the mandrel, a safety cap on the upper end of the mandrel having an inwardly extended annular flange and having perforations, a stop on the lower end of the mandrel closely surrounding the inner pipe and having a duct therethrough, spaced enlargements on said inner pipe section spaced beneath said flange and stop, respectively, an expansible packer element around the mandrel, an expander slidably mounted on the mandrel below the packer element, an inner flange on the expander engageable with the stop on the mandrel, jaws slidably mounted on the expander and expansible into packer supporting engagement with the outer pipe upon downward movement of the expander relative thereto and retractable from the outer pipe upon upward movement of the expander relative thereto, the upper enlargement on the inner pipe being engageable with the upper end of the mandrel, upon downward movement of the inner pipe and being shaped to close the passageway through the mandrel and being effective to force the mandrel downwardly to apply a compressive force to the packer element to expand the same into contact with the outer pipe when the jaws engage the outer pipe in packer supporting engagement, the lower enlargement being engageable with said stop to lift the expander and retract the jaws upon upward movement of the inner pipe.

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