

June 22, 1937.

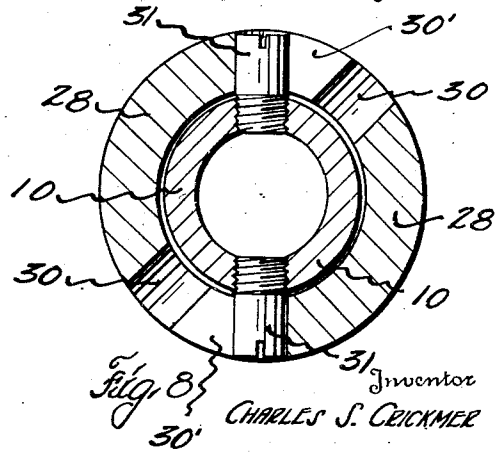
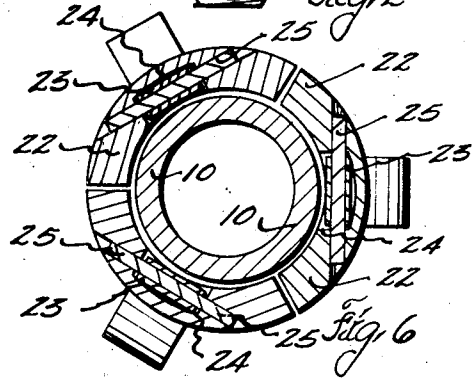
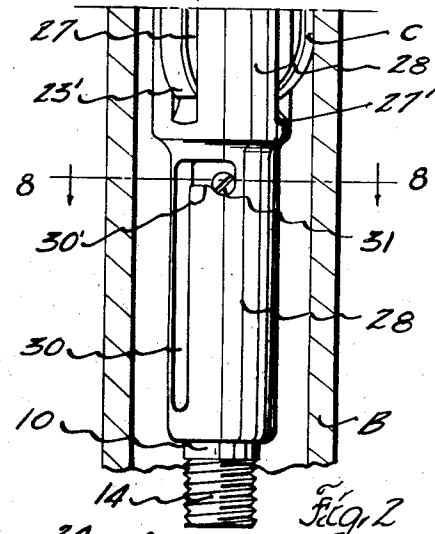
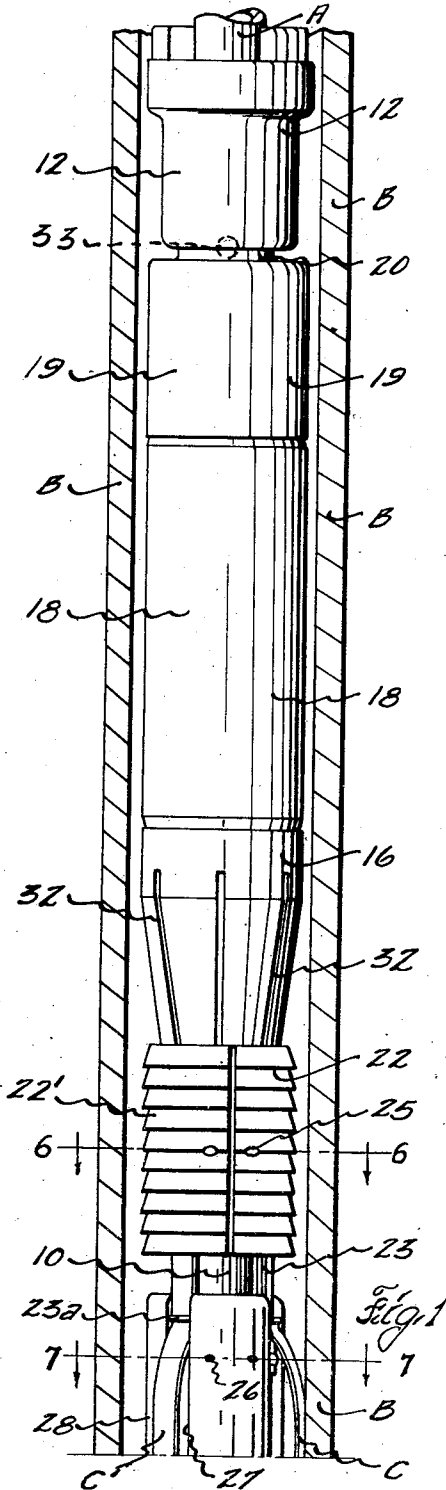
C. S. CRICKMER

2,084,611

PACKER

Filed July 23, 1936

2 Sheets-Sheet 1



Inventor
CHARLES S. CRICKMER

By

Jack Ashley

Attorney

June 22, 1937.

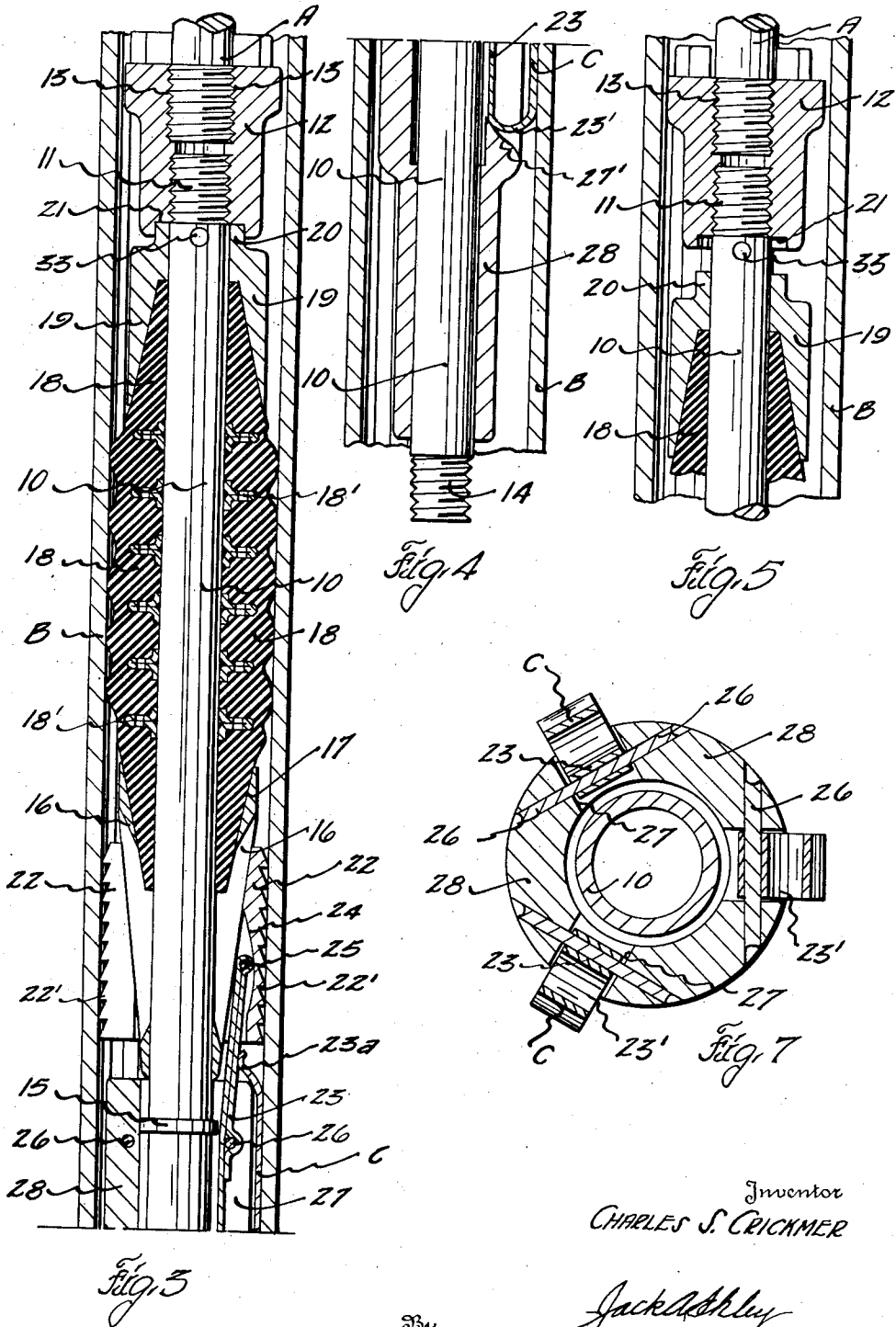
C. S. CRICKMER

2,084,611

PACKER

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2 Sheets-Sheet 2



Inventor
CHARLES S. CRICKMER

Jack A. Kelly
Attorney

UNITED STATES PATENT OFFICE

2,084,611

PACKER

Charles S. Crickmer, Dallas, Tex.

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11 Claims. (Cl. 166—12)

This invention relates to new and useful improvements in packers.

One object of the invention is to provide an improved packer which is particularly adapted for use in supporting an insert pump within the well casing, although it may be used as an ordinary well packer.

An important object of the invention is to provide an improved well packer which is arranged to be set within a well casing and which is provided with means for locking the packer in its set position, whereby the maintenance of the packing seal is assured.

Another object of the invention is to provide an improved packer including a resilient packer element which is supported by a slip cone, and a member slidable through the cone for expanding the element, with means for locking said member and cone to each other after the element has been set which prevents the packer from being jarred or otherwise accidentally loosened from its set position.

A further object of the invention is to provide an improved packer including gripping slips slidable on a slip cone, the slips and cone being so constructed that there is a co-action therebetween which securely locks the cone to the mandrel of the packer when said packer is in a set position.

Still another object of the invention is to provide an improved packer having improved means for draining the fluid from above the packer when it is desired to remove said packer from the well casing.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Figure 1 is an elevation of the upper portion of a packer, constructed in accordance with the invention,

Figure 2 is a continuation of Figure 1, and showing the lower end of the device,

Figure 3 is a transverse, vertical, sectional view of the parts shown in Figure 1,

Figure 4 is a transverse, vertical, sectional view of the parts shown in Figure 2,

Figure 5 is a transverse, vertical, sectional view of the upper end of the packer and showing the mandrel in a raised position,

Figure 6 is a horizontal, cross-sectional view, taken on the line 6—6 of Figure 1,

Figure 7 is a horizontal, cross-sectional view, taken on the line 7—7 of Figure 1, and

Figure 8 is a horizontal, cross-sectional view, taken on the line 8—8 of Figure 2.

In the drawings, the numeral 10 designates a tubular mandrel which has its upper end threaded at 11 to receive the lower end of a coupling collar 12. The upper end of the collar 12 is internally threaded as shown at 13, whereby the lower end of a pump barrel A, may be secured thereto. The lower end of the mandrel 10 is threaded at 14, whereby said mandrel may be connected to the well tubing (not shown). A recovery ring 15 (Figure 3) is formed on the mandrel 10 and is located nearer the lower end thereof.

A slip cone or head 16 surrounds the mandrel 10 and has its lower end supported on the recovery ring 15. The cone is provided with an annular tapered recess 17 in its upper portion, and this recess receives the lower end of an elongate elastic packing member or element 18. The elastic packing element surrounds the mandrel and is slidable thereon, the upper end of said element being tapered to fit within an annular thimble or retaining cap 19 which is also slidably mounted on the mandrel. The thimble or cap 19 is provided with an annular upset flange 20 which normally engages an annular recess 21 formed in the underside of the collar 12 (Figure 3).

With the above arrangement, it will be seen that the cone 16, packing element 18 and thimble 19 are supported on the mandrel by the recovery ring 15. These parts are all slidable with relation to the mandrel and it will be seen that when the cone 16 is held stationary or locked within the well casing B, a continued downward movement of the mandrel 10 would cause the collar 12 which is in engagement with the thimble 19, to force said thimble downwardly with relation to the cone. This would cause the packing element 18 to be moved to its expanded position into engagement with the well casing B as is clearly shown in Figure 3. For reinforcing the packing element 18 and also for causing an equal packing seal throughout the length of the packing element a plurality of reinforcing rings 18' are molded within the packing element. The provision of these rings will cause the packing element to be expanded as shown in Figure 3 whereby the effect of a plurality of packing elements, instead of a single packing element, is obtained.

For locking the cone 16 in a stationary position in the well casing, a plurality of slips 22 are provided, and each slip includes gripping teeth 22' on its outer surface. The slips are slidable

vertically on the cone 16, and due to the inclination of said cone are expanded outwardly into engagement with the inner surface of the well casing B as they move upwardly on said cone.

For supporting each slip 22 in position on the cone a flat spring member 23 is provided. The member 23 has its upper end extending into a recess 24 formed in the rear face of the slip 22, being pivoted on a pin 25 which extends through said slip. The member 23 is also pivoted on a pin 26 which extends across a slot 27 formed in a sleeve 28, which sleeve surrounds the lower end of the mandrel. The member 23 extends downwardly within the slot 27 in close proximity to the mandrel 10 and the extreme lower end of the member 23 is bent upon itself so that said member then extends upwardly in engagement with the wall of the well casing B. The curve 23' which is formed at the lower end of the member 23 rests against the inclined bottom 27' of the slot 27 (Figure 4). The extreme upper end 23a of the member 23 is then bent inwardly to engage the member 23 at a point between the pins 25 and 26 as is clearly shown in Figure 3. With this arrangement, it will be seen that the single member 23 not only forms the link by which the slips 22 are attached to the sleeve 28, but also provides friction springs C which at all times, contact the inner wall of the well casing.

For holding the slips 22 in their retracted position while the device is being lowered into the well casing, the sleeve 28 is provided with a pair of J-slots 30 which are located diametrically opposite each other at the lower end of said sleeve (Figure 2). Radial pins 31 which are secured to the tubular mandrel 10 extend outwardly into the slots 30. It will be seen that when the pins 31 are located in the horizontal leg 30' of each J-slot, that the sleeve 28 is locked to the mandrel 10 and will move therewith. When said pins are in such position, the slips 22 are at the extreme lower end of the cone 17 and are thus, retracted from the wall of the well casing.

When the device has been lowered to its proper position within the well casing, it is only necessary to rotate the mandrel 10 in a clockwise direction (Figure 8), so that the pins 31 are moved into alignment with the vertical legs of the J-slots. When this is done downward movement of the mandrel 10 is continued, and said mandrel moves downwardly through the sleeve 28, because said sleeve is being held stationary by the friction springs C secured thereto. Since the slips 22 are directly connected to the sleeve 28 by the members 23, it will be obvious that as the sleeve is held stationary, the slips 22 will also be stationary. Therefore, continued downward movement of the mandrel 10 will cause the cone 16 to ride downwardly within the slips 22, thereby expanding said slips into engagement with the wall of the well casing B.

After the cone has been locked in position as above explained, the weight of the mandrel and the parts thereabove will move said mandrel downwardly through the cone so that the thimble 19 at the upper end of the packing element 18, will expand said packing element into engagement with the well casing, as is clearly shown in Figure 3. After the packing has moved into its sealing position, it will be obvious that the entire weight of the device is carried by the slips 22 and there is a tendency for the cone to be moved downwardly within the slips which are, of course, in engagement with the well casing B.

The cone 16 is provided with a plurality of

vertical slots 32 which extend substantially throughout the cone-shaped portion of said cone. Any desired number of slots may be provided in the surface of said cone. These slots are an important feature of the invention because after the packing has moved into its engagement with the well casing B, any further downward movement of the cone within the slips 22 will cause the cone to be reduced in diameter. This reduction of diameter of the cone 16 will cause the inner periphery of said cone to frictionally engage the outer surface of the mandrel 10. When this occurs, it will be obvious that the cone 16 will be rigidly and securely clamped to the mandrel and thus the cone and mandrel are locked to each other.

If the packer is employed to support an insert pump, it will be obvious that by locking the cone to the mandrel that accidental displacement of the packing element 18 due to the vibration or jarring action of the pump, will be obviated. In other words, by clamping the cone around the mandrel, it is impossible for the packing element to be disengaged from the casing wall unless a comparatively strong upward pull on the mandrel is had. This is advantageous because the vibration incidental to the pumping action is sufficient to break the seal of the packing element and therefore, with the arrangement above described, the packing is more or less locked in its set position.

When it is desired to remove the packer from the well casing B, it is only necessary to exert an upward pull on the coupling collar 12 at the upper end of the mandrel. This immediately causes the mandrel to move upwardly through the cone, packing element 18 and thimble 19. It is well known that after an elastic packing element has been set within a well for some time, the outer periphery or packing surface of said element will adhere or stick to the wall of the well casing. Therefore, as the mandrel moves upwardly the thimble 19 and packing element 18 will retain their packed position as shown in Figure 3. This causes the upstanding annular flange 20 at the upper end of the thimble 19 to be disengaged from within the recess 21 in the lower end of the collar 12. Continued upward movement of the mandrel permits uncovering of a port 33 which is provided in the mandrel 10 below the screw threads 11. When this port is uncovered, it will be obvious that the fluid above the packing element 18 may pass between the collar 12 and thimble 19 and escape through the port 33, and then downwardly through the tubular mandrel 10. This relieves the load or weight of the fluid above the packing element 18 and a continued upward pull on the mandrel will permit easy removal of the entire device from the well casing B.

What I claim and desire to secure by Letters Patent, is:

1. A well packer including, a mandrel, a packing element surrounding the mandrel, a cone slidable on the mandrel for supporting the packing element, means for distorting the element into packing position, and means for frictionally clamping the cone to the mandrel after the packing element has been set, whereby said element is retained in its set position.

2. A well packer including, a mandrel, a packing element surrounding the mandrel, means for supporting the packing element in position on said mandrel, means for distorting the packing element into packing position, means for fric-

tionally clamping the mandrel to the element supporting means after said element has been distorted, whereby said element is retained in its set position, and means for draining the fluid from above the packing element when the device is being raised.

3. A well packer including, a mandrel, a packing element surrounding the mandrel, a cone slidable on the mandrel for supporting the packing element, means for distorting the element into packing position, means for frictionally clamping the cone to the mandrel after the packing element has been set, whereby said element is retained in its set position, and means for draining the fluid from above the packing element when the device is being raised.

4. A well packer adapted to be lowered into a well casing including, a mandrel, a slip cone slidable on said mandrel, an annular packing element having its lower end supported in the cone, means on the upper end of the mandrel engaging the upper end of the element, whereby the weight of the mandrel may be placed on said element, means for locking the cone within the well casing to prevent further downward movement thereof, whereby the mandrel slides through said cone and the weight of said mandrel distorts the element into packing position, and means for frictionally clamping the cone to the mandrel after the element is set.

5. A well packer adapted to be lowered into a well casing including, a mandrel, a slip cone slidable on said mandrel, an annular packing element having its lower end supported in the cone, means on the upper end of the mandrel engaging the upper end of the element, whereby the weight of the mandrel may be placed on said element, means for locking the cone within the well casing to prevent further downward movement thereof, whereby the mandrel slides through said cone and the weight of said mandrel distorts the element into packing position, means for frictionally clamping the cone to the mandrel after the element is set, and means on the mandrel for engaging beneath the cone so that an upward pull on said mandrel will raise the cone and packing element to permit removal of the device from the casing.

6. A well packer adapted to be lowered into a well casing including, a mandrel, a slip cone slidable on said mandrel, an annular packing element having its lower end supported in the cone, means on the upper end of the mandrel engaging the upper end of the element, whereby the weight of the mandrel may be placed on said element, means for locking the cone within the well casing to prevent further downward movement thereof, whereby the mandrel slides through said cone and the weight of said mandrel distorts the element into packing position, means for frictionally clamping the cone to the mandrel after the element is set, means on the mandrel for engaging beneath the cone so that an upward pull on said mandrel will raise the cone and packing element to permit removal of the device from the casing, and means above the packing element for draining fluid from above said element as the same is lifted in the casing.

7. A well packer adapted to be lowered into a well casing including, a mandrel, a slip cone slidable on said mandrel, an annular packing element having its lower end supported in the cone, means on the upper end of the mandrel engaging the upper end of the element, whereby the weight of the mandrel may be placed on said element, a plurality of slips slidable vertical-

ly on the surface of the cone, whereby when said cone moves downwardly with relation to the slips the latter are moved into engagement with the casing, means for moving the slips downwardly in their retracted position with the mandrel and cone, means for engaging the slips with the casing to prevent further downward movement of said cone, whereby the weight of the mandrel is placed on the packing element to distort the same, and means for frictionally clamping the cone to the mandrel after said element has been set.

8. A well packer adapted to be lowered into a well casing including, a mandrel, a slip cone slidable on said mandrel, an annular packing element having its lower end supported in the cone, means on the upper end of the mandrel engaging the upper end of the element, whereby the weight of the mandrel may be placed on said element, means for locking the cone within the well casing to prevent further downward movement thereof, whereby the mandrel slides through said cone and the weight of said mandrel distorts the element into packing position, and means for reducing the diameter of the cone whereby said cone frictionally clamps to the mandrel after the element has been set.

9. A well packer adapted to be lowered into a well casing including, a mandrel, a slip cone slidable on said mandrel, an annular packing element having its lower end supported in the cone, means on the upper end of the mandrel engaging the upper end of the element, whereby the weight of the mandrel may be placed on said element, a plurality of slips slidable vertically on the surface of the cone, whereby when said cone moves downwardly with relation to the slips the latter are moved into engagement with the casing, means for moving the slips downwardly in their retracted position with the mandrel and cone, and means for engaging the slips with the casing to prevent further downward movement of said cone, whereby the weight of the mandrel is placed on the packing element to distort the same, the cone having a plurality of vertical slots therein whereby after the packing element is set and the weight above the cone forces said cone further between the slips engaging the casing, said slips act to reduce the diameter of the cone to frictionally clamp the cone to the mandrel.

10. A well packer adapted to be lowered into a well casing including, a mandrel, a slip cone slidable on said mandrel, an annular packing element having its lower end supported in the cone, means on the upper end of the mandrel engaging the upper end of the element, whereby the weight of the mandrel may be placed on said element, a plurality of slips slidable vertically on the surface of the cone, whereby when said cone moves downwardly with relation to the slips the latter are moved into engagement with the casing, means for moving the slips downwardly in their retracted position with the mandrel and cone, means for engaging the slips with the casing to prevent further downward movement of said cone, whereby the weight of the mandrel is placed on the packing element to distort the same, the cone having a plurality of vertical slots therein whereby after the packing element is set and the weight above the cone forces said cone further between the slips engaging the casing, said slips act to reduce the diameter of the cone to frictionally clamp the cone to the mandrel, and means on the mandrel for engaging beneath the cone so that an upward pull on said mandrel will raise the

cone and packing element to permit removal of the device from the casing.

11. A well packer adapted to be lowered into a well casing including, a mandrel, a slip cone 5 slidable on said mandrel, an annular packing element having its lower end supported in the cone, means on the upper end of the mandrel engaging the upper end of the element, whereby the weight of the mandrel may be placed on said 10 element, a plurality of slips slidable vertically on the surface of the cone, whereby when said cone moves downwardly with relation to the slips the latter are moved into engagement with the casing, means for moving the slips downwardly 15 in their retracted position with the mandrel and cone, means for engaging the slips with the cas-

ing to prevent further downward movement of said cone, whereby the weight of the mandrel is placed on the packing element to distort the same, the cone having a plurality of vertical slots therein whereby after the packing element is set and the weight above the cone forces said cone further 5 between the slips engaging the casing, said slips act to reduce the diameter of the cone to frictionally clamp the cone to the mandrel, means on the mandrel for engaging beneath the cone so 10 that an upward pull on said mandrel will raise the cone and packing element to permit removal of the device from the casing, and means above the packing element for draining fluid from above said element as the same is lifted in the casing. 15

CHARLES S. CRICKMER.