Sept. 14, 1937. M. O. JOHNSTON 2,093,129

PACKER

Filed June 1, 1936

Fig 1

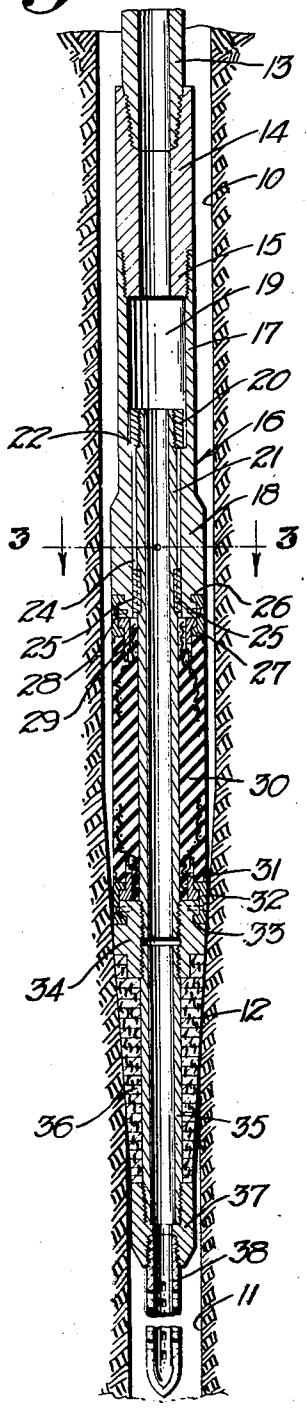


Fig 2

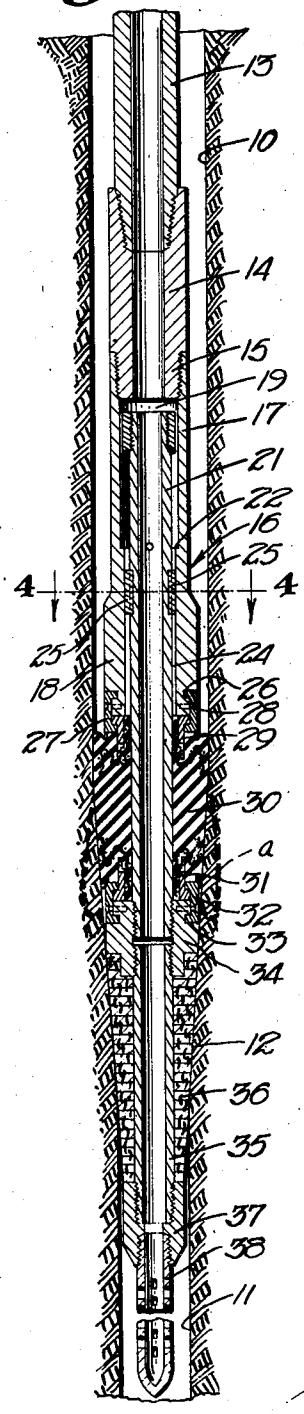


Fig 3

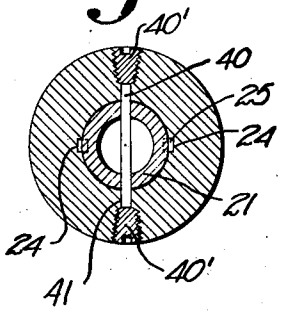
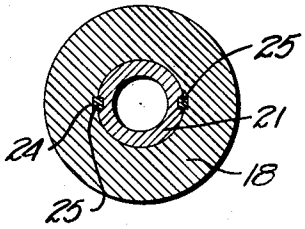


Fig 4



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PACKER

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3 Claims. (Cl. 166—1)

This invention relates to oil well tools and particularly pertains to a well packer.

In drilling oil wells it is often necessary to set a well packer in an open hole. This is particularly true when a formation test is to be made and a sample of fluid is desired from the formation within a rathole. At such times the well bore is full of drilling fluid and a length of hole of a desired well diameter has already been drilled, and in order to make a test, a hole is then drilled having a relatively small diameter. This hole of small diameter is for exploration purposes and is called a rathole. At the juncture between the bottom of the well bore and the rathole a tapered shoulder occurs, the large diameter of which is represented by the diameter of the well bore, and the small diameter represented by the diameter of the rathole. It is common practice to tend to seal off the fluid of the well above the shoulder from the formation fluid occurring below the shoulder. This is usually accomplished by the use of a rathole packer which, as commonly constructed, has a cylindrical packing length at its upper end followed by a lower frusto-conical portion adapted to seat upon the tapered seat of the mouth of the rathole. In such instances it usually occurs that the cylindrical portion of the rathole packer extends upwardly into the well bore without producing any packing action due to its relatively small diameter as compared with the well bore. This makes it possible for the hydrostatic pressure of the fluid column within the well to exert its force around the cylindrical portion of the packer and tend to cut the tapered seat of the rathole so that the formation will fall away and permit the rathole packer to become unseated. This action is of course aggravated when a complete or partial packing off has been effected and a flow from the formation permitted through the packer and its testing device, since at that time the pressure beneath the packer will be greatly relieved, while the fluid column pressure above the packer will maintain its relatively high head. It is the principal object of the present invention to provide a packer especially adapted for effecting a complete fluid shut-off at a shoulder within a well bore and which will insure that the combined action of the weight of drill string carrying the packer and the hydrostatic pressure of the column of fluid within the hole will cooperate to hold the packer on its seat and to prevent its seat from being cut away.

The present invention contemplates the provision of a packer including a rathole packer which while usually non-metallic is not readily deformable, and a deformable sleeve packer cooperating therewith under the pressure exerted by the weight of the drill string and the fluid column to form a fluid seal in a well bore.

The invention is illustrated by way of example in the accompanying drawing in which:

Figure 1 is a view in central longitudinal section showing a packer of the construction with which the present invention is concerned partially set within a well.

Fig. 2 is a view in central longitudinal section showing the packer with which the present invention is concerned completely set within a well.

Fig. 3 is a view in transverse section showing the shear pin arrangement as seen on the line 3—3 of Fig. 1.

Fig. 4 is a view in transverse section showing the spline arrangement as seen on the line 4—4 of Fig. 2.

Referring more particularly to the drawing, 10 indicates a well bore of the usual well diameter. 11 indicates a rathole bore of reduced diameter and 12 indicates a tapered shoulder intermediate the well bore 10 and the rathole 11. It is desirable to form a fluid seal between the well bore 10 and the rathole 11 and to shut off the column of liquid or drilling fluid within the bore 10 from the formation fluids occurring within the geological formation penetrated by the rathole 11. This in the present invention is accomplished by a packer structure supported upon a drill string or a tubular member 13 of a testing tool. The lower end of the member 13 is threaded to engage the box of a sub 14. The lower end of the sub is formed with a pin 15 threaded into a sleeve structure 16. This sleeve structure includes an upper cylindrical and tubular member 17 terminating a body member 18. The tubular member 17 provides a compartment 19 within which the head 20 of a tubular packing mandrel 21 may reciprocate. The head 20 is in the form of a nut threaded on to the upper end of the tubular mandrel and which may engage an abutting shoulder 22 of the body member 18. This threaded extension receives the lower end of the sleeve 17. The body member 18 is formed with keyways 24 which extend longitudinally of the central bore thereof and receive keys 25 carried in the opposite sides of the mandrel 21 so that relative longitudinal movement may take place between the body member 18 and the mandrel while permitting positive rotation of these parts in unison at all times. An annular groove 26 is formed around

the circumference of the body member 18 adjacent to its lower end and receives a split fastening ring 27, the parts of which are held in assembled relation to the body member 18 by screws 28. The fastening ring is of channel section. Its upper leg fits within the groove 26 and its lower leg fits beneath a shoulder of a packing ferrule 29. This ferrule has a cylindrical portion extending downwardly and formed with a perforation through its wall so that it may become embedded within a sleeve packing element 30 and so that the rubber of which the sleeve packer 30 is made may flow through and become solidified in the opening through the ferrule. In this manner the ferrule will be held rigidly by the ring 27 with its upper face abutting against the lower face of the body member 18. The packing sleeve 30 is usually formed of rubber having the characteristic that when weight is imposed upon it, it will be deformed from its usual cylindrical shape to be longitudinally compressed and laterally expanded. The lower end of this packing sleeve is fitted with a ferrule 31 similar to ferrule 29 previously described, having an end flange engaged by one leg of a channel section clamping ring 32. The other leg of this ring engages a groove 33 of a coupling 34 which is threaded on to the lower end of the mandrel 21 and is threaded into the upper end of a lower mandrel section 35 upon which a rathole packer 36 is mounted. The body of the rathole packer is formed preferably of laminations of packing material, such for example as might be made from rubber belting within which a fabric is incorporated. Such a packer may readily adapt itself to a seat against which it is forced and has the additional advantage of being pulled or drawn away from the seat in case there is a tendency for it to stick. The material of the rathole packer is relatively hard as compared to that of which the sleeve packer is made. Thus the rathole packer may be wedged into the tapered seat 12 while the material of the sleeve packer 30 may be deformed and will in effect flow outwardly and downwardly over the lower ferrule 32. The lower end of the rathole packer is fitted with a nut 37 which is threaded on to the mandrel 35 and which in turn receives a perforated nipple 38 into which fluid may flow from the geological formation being penetrated by the well bore.

In order to prevent the sleeve packer from becoming compressed accidentally as the tool is run into the hole the sleeve and the mandrel are temporarily pinned together by a shear pin 40 which extends through the body member 18 as indicated in Fig. 3. This pin is preferably slipped into position within a bore 41 and is held in position by threaded plugs 40'. This pin extends through the tubular mandrel so that excessive downward pressure of the body member 18 would shear off the pin 40 and allow the body member to move downwardly over the mandrel.

In operation of the present invention the structure is assembled as shown in the drawing and the body member 18 is temporarily pinned to the mandrel 21 by the shear pin 40. In this position the sleeve packer 30 will be held without compression. The entire structure is then lowered into a well bore until the rathole packer finds the seat 12. The imposition of additional weight will force the rathole packer into its seat and when sufficient weight is imposed will cause the shear pin 40 to be sheared so that the body member 18 may move downwardly on the mandrel and longitudinally compress the packing 30. This compression of the deformable packing sleeve 30 will force the sleeve outwardly and downwardly causing it to fill the large diameter of the well bore, and if there is sufficient resistance a combination of the weight imposed upon the drill string and the pressure of the fluid column may cause the lower edge of the packing to flow over the ferrule as indicated by dotted lines at "a" in Fig. 2. In any event it will be evident that the combined action of the two packers made of materials having different characteristics will insure that they will cooperate to seal off the liquid column in the well from the formation area to be tested.

It will be obvious further that this sealing off action will be attained due to the fact that the lower conical rathole packer will be forced into the tapered rathole seat and will then resist further downward movement so that compression of the sleeve packer will cause its deformation and will completely fill the space in the well bore directly above the rathole packer. When the packers are to be withdrawn it will be noted that an upward pulling action exerted by the drill stem will cause the sleeve packer to be stretched longitudinally so that it will clear the bore of the well, after which the rathole packer will be lifted when the head 20 encounters the shoulder 22 of the body member 18.

It will thus be seen that the packing structure here disclosed provides simple and effective means whereby a positive shut-off may be made between two fluids within a well bore and whereby the packing elements may be easily removed after their use.

While I have shown the preferred form of my invention, as now known to me, it will be understood that various changes might be made in the combination, construction, and arrangement of parts by those skilled in the art, without departing from the spirit of the invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A well packer structure comprising a central tubular mandrel, a rathole packer mounted on the lower end thereof, a shoulder on the mandrel above the rathole packer, a deformable sleeve packer disposed on the mandrel above the shoulder, a body member slidably mounted upon the upper end of the mandrel and bearing upon the upper end of the sleeve packer, said body member being formed with a central tubular bore within which the mandrel is slidably mounted and a counterbore at its upper end, a drill string connection at the upper end of the counterbore for supporting the structure, a head formed on the upper end of the mandrel and disposed within said counterbore for limited longitudinal movement and a splined connection between the bore of the body member and the mandrel whereby said members will be held against rotation.

2. A well packer structure comprising a central tubular mandrel, a rathole packer mounted on the lower end thereof, a shoulder on the mandrel above the rathole packer, a deformable sleeve packer disposed on the mandrel above the shoulder, a body member slidably mounted upon the upper end of the mandrel and bearing upon the upper end of the sleeve packer, said body member being formed with a central tubular bore within which the mandrel is slidably mounted and a counterbore at its upper end, a drill string connection at the upper end of the counterbore for supporting the structure, a head formed on the upper end of the mandrel and disposed with-

in said counterbore for limited longitudinal movement and a splined connection between the bore of the body member and the mandrel whereby said members will be held against rotation, and a shear pin extending through the mandrel and the body member when the head of the mandrel is at the bottom of the counterbore whereby the sleeve packer will be held temporarily in its extended position.

3. A well packer structure comprising a body member having a central tubular opening therethrough and a counterbore at its upper end, a drill string connection engaging the upper end of said counterbore and permitting an unobstructed length of counterbore to occur therebeneath, a tubular mandrel longitudinally slidable within the bore of said body member and extending downwardly therefrom, a splined connection between the mandrel and the body member, a head on the mandrel disposed within said counterbore to limit relative movement between the body member and the mandrel, a deformable sleeve packer mounted upon the mandrel beneath the body member, a fixed packer shoulder secured to the lower end of the mandrel and upon which said sleeve packer rests, a mandrel extension extending downwardly from said fixed shoulder, a packer mounted upon said mandrel extension and a nut secured upon said mandrel extension to fasten the last named packer in position.

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