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MEANS FOR EQUALIZING LOAD ON TWO END PLATES OF INFLATABLE REINFORCED PACKER

Filed Sept. 19, 1955

FIG. 1.

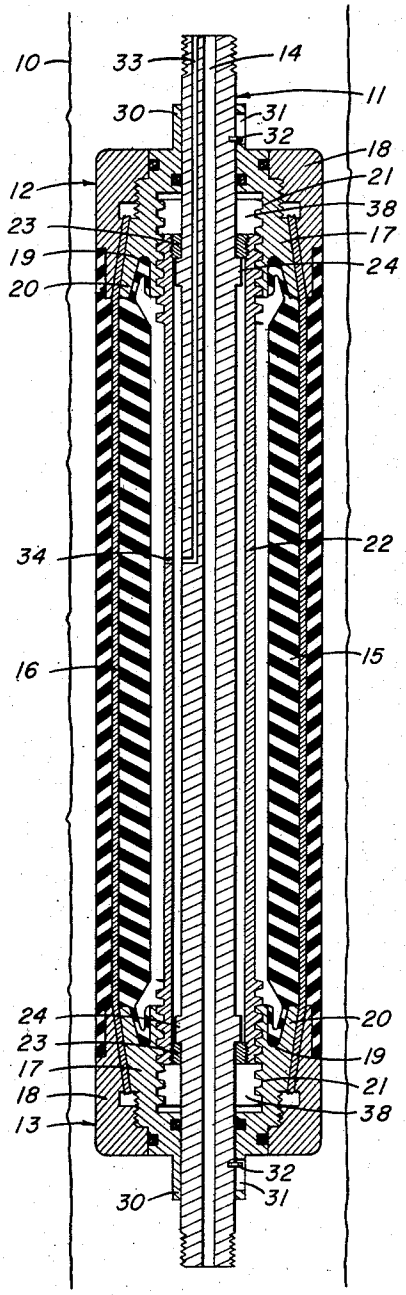


FIG. 2.

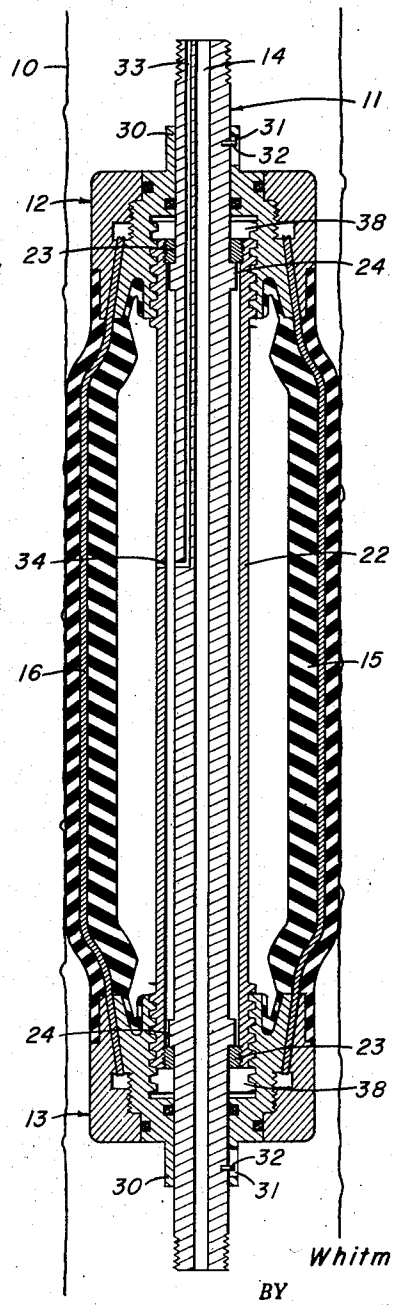
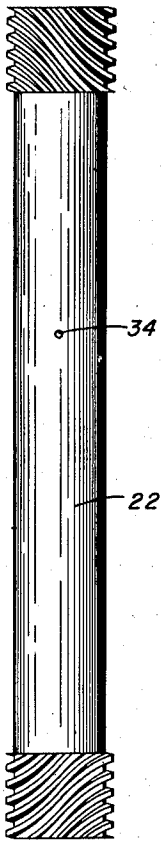


FIG. 3.



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MEANS FOR EQUALIZING LOAD ON TWO END PLATES OF INFLATABLE REINFORCED PACKER

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2 Claims. (Cl. 166—187)

This invention relates to an improved well packer. More particularly this invention relates to a novel structure for equalizing the load between an upper support and a lower support on a well packer utilized in well operations.

In well operations such as those carried out in the taking of drill stem tests of the fluids in a subsurface formation, it is common practice to seal off the producing subsurface formation by means of a single packer if the subsurface formation is located near or at the bottom of a borehole or to straddle the subsurface formation with a plurality of packers if the producing formation is located upwardly from the bottom of the borehole. However, many previous packers have been unable to withstand the very high pressures found within a deep borehole. This is so because the pressure exerted upon a packer after it has been inflated is concentrated at an area of the expansible rubber member which is located just above the lower support member causing the rupture of the expansible rubber member in this area.

It is an object, therefore, of this invention to provide a means for equally distributing the hydrostatic pressures exerted upon a packer between the upper support member and the lower support member.

Briefly described my new invention consists of an inflatable tubular member which is mounted on a shaft by means of a first support member and a second support member, with said support members being adapted to move longitudinally toward one another when the inflatable member is being inflated. Means are provided within the inflatable member for equalizing the load exerted upon the packer after it has become inflated.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings in which:

Fig. 1 is a sectional elevational view showing my new packer in the deflated position;

Fig. 2 is a sectional elevational view similar to Fig. 1 showing my new packer in the inflated position; and

Fig. 3 is an elevational view of my new load equalizing member.

Referring more particularly to the drawings numeral 10 indicates a borehole into which my new inflatable packer has been inserted. Though one inflatable packer is shown in the drawings it is to be understood that if desired a plurality of inflatable packers might be utilized. In fact, two of the improved packers may be used to straddle an interval or formation to be isolated and/or tested. Mounted upon a shaft or mandrel 11 is an upper support member 12 and lower support member 13. Support members 12 and 13 are spaced from one another longitudinally upon shaft 11 and may be mounted coaxially with shaft 11. Shaft 11 is provided with a passageway 14 through which the fluids obtained from the subsurface formation being tested may be flowed and subsequently removed to the earth's surface for examination through a pipe or tubing threadedly connected to

the mandrel or shaft 11. Mounted upon the upper support member 12 and the lower support member 13 and coaxially about the shaft member 11 is an expansible tubular member 15. The expansible tubular member 15 may have embedded therein reinforcing means 16, which reinforcing means may consist of steel cables or in the alternative a braided reinforcing sock such as the braided steel sock described in my co-pending patent application Serial No. 520,424, filed July 7, 1955.

The upper and lower support members 12 and 13 are each made up of two parts, a substantially frustro-conical sleeve 17 and a wedging member 18. The frustro-conical sleeves 17 have formed therein rounded out portions 19 and outwardly flaring portions 20. The rounded out portions 19 serve to embrace the inflatable rubber member 15. The rubber member 15 is bonded to the sleeves 17 and also bonded to the wedging members 18. The sleeve members 17 have threaded bores 21 formed therein. The threaded bores 21 are adapted to matingly receive the threaded upper and lower extremities of a rigid tubular load transfer tube 22. The load transfer tube 22 has threaded therein, at each of its longitudinal extremities, a ring member 23. Ring members 23 engage longitudinally spaced shoulders 24 formed upon shaft 11. Hence, it can be seen that the load transfer tube 22 is prevented from moving longitudinally along shaft member 11 but is permitted to rotate about shaft 11.

Sleeve members 17 have extensions 30 of reduced diameter. Slots 31 are formed in the extensions 30 which slots are adapted to receive stop members 32. An inflation fluid passageway 33 is provided within shaft 11 and an inflation fluid port 34 is provided in the load transfer tube 22 to permit the passage of inflation fluid into the space defined by the load transfer tube 22 and the expansible tubular member 15. The inflation fluid is supplied by means of a pump (not shown). The pump may be located within the tubing to which mandrel 11 is connected or it may be at the surface of the earth.

When my new packer is deflated a space 38 is provided between the longitudinal extremity of the load transfer tube 22 and the bottom of the bores 38 within sleeve members 17. This arrangement permits the longitudinal movement of the support members toward one another as the packer is being inflated.

As shown in Fig. 3 the threaded portions of the load transfer tube 22 are steeply pitched with one end of the load transfer tube 22 being formed in a left handed thread and the other end of the load transfer tube 22 being formed as a right handed thread, thus permitting the movable support members 12 and 13 to readily move toward one another as the packer is inflated.

In operation, my new packer is first lowered into position within the borehole 10 and then inflated to seal off the subsurface formation which it is desired to test. The packer may be lowered by lowering the tubing or by wireline. Inflation fluid is then pumped through inflation fluid passageway 33 and port 34 to expand the tubular member 15 so as to seal off the subsurface formation. As the tubular member 15 expands, the load transfer tube 22 will rotate about shaft member 11 as the support members 12 and 13 move longitudinally toward one another. After the packer has become inflated and a pressure differential exists across tubular member 15 any local strain caused by the pressure differential will be distributed by the load transfer tube 22. For example, when taking drill-stem tests, the packer is in inflated condition and a higher pressure exists above tubular member 15 than exists below tubular member 15. Tubular member 15 or portions thereof move downwardly under the pressure differential and thereby move support member 13 downwardly. Movement of support member 13 downwardly rotates tube 22 which moves up-

per support member 12 upwardly thereby equalizing the load between the support members and preventing rupture of tubular member 15 and kinking of cables 16. Therefore, the inclusion of the load transferring means provides a packer which is able to withstand higher pressures than the pressures which can be withstood by previous well packers and, therefore, is quite useful.

Although I have described my invention with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What I wish to claim as new and useful is:

1. In a well packer: a shaft, first and second spaced apart support members slidably arranged on said shaft, a rigid rotatable tubular member surrounding said shaft and extending between said support members, a fluid inflatable member surrounding said tubular member and connected to said first and second support members, means for inflating said inflatable member, stop means on said shaft adapted to prevent longitudinal movement of said tubular member, steep-pitched right-handed mating threads interconnecting one end of said tubular member and one of said support members and steep-pitched left-handed mating threads interconnecting the other end of said tubular member and said other support member whereby movement of one of said support members in one direction rotates said tubular member to move said other support member in an opposite direction, said directions of movement of said support members being toward each other when said inflatable member is inflating and being away from each other after said inflatable member has been inflated when equalizing a load carried by said support members between said support members.

2. In a well packer: a shaft, a first support member slidably mounted upon said shaft and provided with a steep-pitched left-handed screw-threaded bore, a second support member slidably mounted upon said shaft and provided with a steep-pitched right-handed screw-threaded bore, said first and second support members being spaced apart, an inflatable member surrounding said shaft and connected to said first and second support members, said inflatable member being formed to provide greater rigidity longitudinally than laterally, means for inflating said inflatable member, a rigid tubular member mounted on said shaft, and first and second spaced apart stop means formed on said shaft adapted to prevent longitudinal movement of said tubular member, said tubular member being provided with steep-pitched threads adjacent the end thereof adapted to mate with the threaded bores of said support members whereby movement of one of said support members in one direction rotates said tubular member to move said other support member in an opposite direction, said direction of movement of said support members being toward each other when said inflatable member is inflating and being away from each other after said inflatable member has been inflated when equalizing a load carried by said support members between said support members.

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