Jan. 9, 1940. W. L. BALD 2,186,230

HYDRAULIC OIL WELL PACKER

Filed Aug. 11, 1938

FIG. 1.

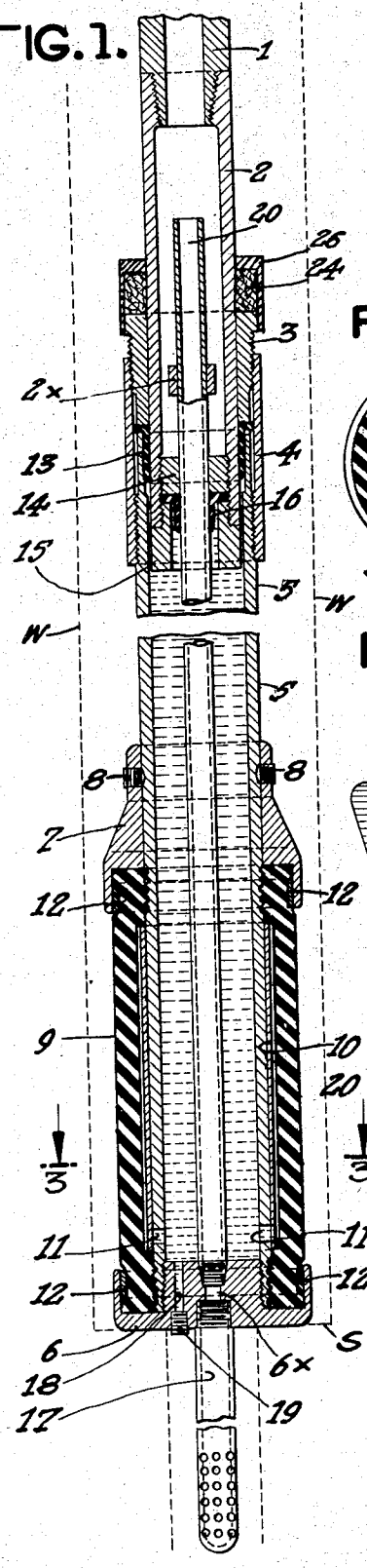


FIG. 2.

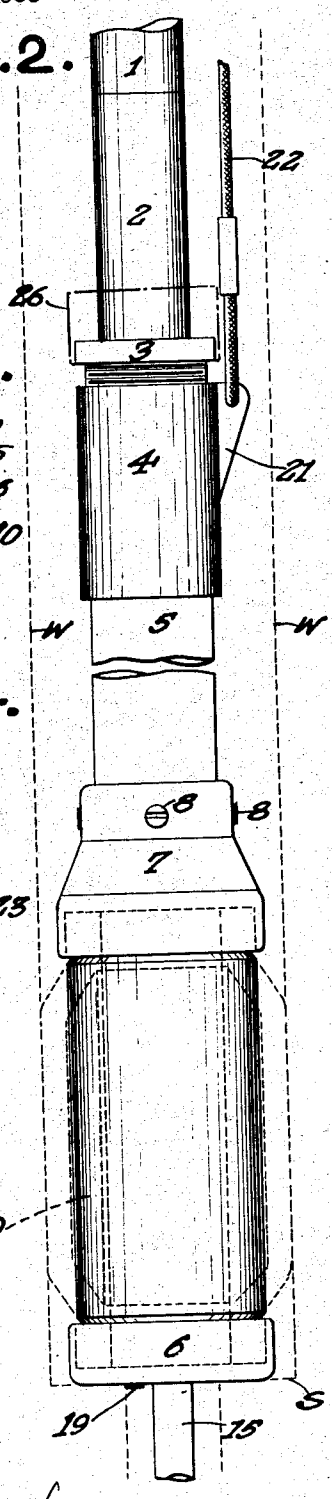


FIG. 3.

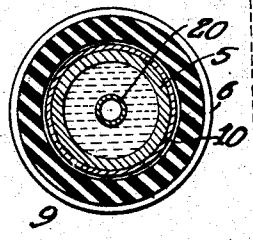
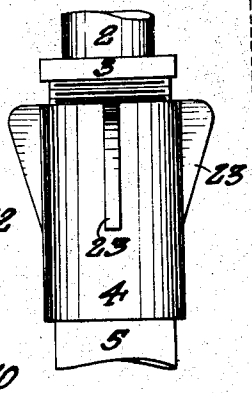


FIG. 4.



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HYDRAULIC OIL WELL PACKER

Warren L. Bald, Los Angeles, Calif.

Application August 11, 1938, Serial No. 224,230

1 Claim. (Cl. 166—1)

The function of an oil well packer is to shut off the flow of fluid (such as fluid, mud or water) longitudinally of the well at the point selected. The packer is so placed and constructed as to cause it to firmly engage the interior wall of the well and to act as a plug to shut off said flow of fluid from either below or above the point at which the packer was applied, depending upon the purpose for which the packer is used.

It is common practice in oil well drilling to keep the well hole filled with fluid, mud or water during the drilling operation period. This fluid exerts a characteristic pressure at all points inside the well hole and outwardly against the wall of the well. By these means when the drilling operations project through a strata in which there is oil, water or gas, itself under high pressure, the fluid pressure inside the well hole counteracts pressure of the oil, water or gas and prevents it from seeping into the well. The interior well pressure also resists collapse of the well wall from such exterior pressure.

By means of the present invention various problems not overcome by oil well packers of known construction are overcome as will be hereinafter set forth.

The invention will be described with reference to the accompanying drawing, in which:

Figure 1 is a longitudinal section showing well walls in dotted lines and an embodiment of the invention within the well and resting on the well shoulder, the embodiment being shown in longitudinal section and partly broken away.

Figure 2 is a view in elevation, partly broken away, showing the exterior of the said embodiment, dotted lines showing the boundary lines of the well and dotted lines showing the unexpanded and expanded positions of the sealing sleeve.

Figure 3 is a horizontal section on the line 3—3, Figure 1.

Figure 4 is a detailed view of an eared barrel sleeve adapted for use in the assembly.

Referring to the drawing, I have indicated at *w* the upper well wall and at *s* the well hole.

At the upper end of the structure is a tubular drill stem 1 formed with a reduced threaded end upon which is received the upper threaded end of the plunger shaft 2. Upon an exterior of the plunger shaft is a sleeve nut 3 termed a barrel gland nut and threaded upon the same is the barrel sleeve 4, the barrel sleeve being internally threaded at its opposite ends, the lower end of the barrel sleeve is threaded upon the barrel 5 which is closed at its lower end by a flange base cap 6.

Supported within the flange of the base cap 6 is expanding sleeve 9, the top of the sleeve being received within the flanged cup-like sleeve area of top cap 7 which surrounds barrel 5 and is fixed thereon by the set screws 8 or by any other suitable means.

Intermediate barrel 5 and the expanding sleeve 9 is a light metallic sleeve 10 and through the sleeve and the barrel toward the lower end of the latter are formed ports 11 through which liquid from the barrel may flow under pressure to the interior of the expanding sleeve, the latter being normally slightly spaced from the light metallic sleeve 10 except at its top and base areas. These latter areas receive clamps 12 which preferably are surmounted by the flanged areas of the caps 6 and 7. The action of the clamps 12 upon the expanding sleeve is against a serrated, threaded or otherwise roughened surface of barrel 5 so that the sleeve at the clamp points may be firmly bonded thereto.

The function of the barrel gland nut 3 is to compress and hold flanged packing 13 between the barrel 5 and plunger shaft 2 and also over the shouldered end of the barrel. The gland nut also acts as a guide for the plunger shaft. The lower end of the plunger shaft has interiorly threaded an apertured plunger plug 14 below which is threaded in barrel 2 the plunger head 15, a packing 16 being pressed between the two.

The test efflux tube 20 projects through members 14 and 15 being surrounded by the packing 16 and extends downwardly to base cap 6 into which it is threaded. The tube communicates with a duct at 6*x* in cap 6, the duct in turn communicating with perforated intake pipe 17 which is threaded or otherwise secured to base cap 6. Drain duct 18 passes through cap 6, being normally closed by base drain plug 19.

Plunger shaft 2 at its inner wall is provided with a plunger stop 2*x* which is apertured to receive efflux tube 20.

Method of operation

In the position of the parts shown in the drawing, the plunger is in the extreme upward end of its stroke, and in this position the expanding sleeve 9 is retracted. The device is lowered into the well by means of its drill stem which may be formed of interconnected sections in order to secure the necessary length. When the base of the device reaches the well shoulder *s* or other desired point, it comes to a position of rest.

Thereupon the plunger shaft 2 actuated by the weight of the attached drill stem moves in a downward stroke, forcing fluid contained within the barrel (and indicated by transverse dotted line in the drawing) outwardly through the ports 11, causing the outward expansion of the expanding sleeve 9 against the well wall.

The described mehod of operation is used, for example, when it is desired to remove fluid from below the device up into the drill stem and also the points above the stem for either "formation testing" or for the removal of oil below the device by pumping or natural flow, the oil passing through the efflux tube 20.

When the device is to be utilized for a bottom packer, i. e., at the bottom or base of the well, the perforated pipe 17 is replaced by a solid plug, so that the base cap 6 will offer a solid face for seating on the base of the wall.

When there is no well shoulder base upon which the packer may be lowered, it is necessary to provide a means for stopping the packer body in its descent. This may be accomplished by constructing the barrel sleeve 4 with a lug 21 formed with an eye through which a cable 22, leading upwardly, is attached. As the packer is lowered into the well by means of the drill stem, the cable is also paid out into the well at the same time. When the desired point to seal is reached, a strain is taken on the cable, which acts as a stop, holding the packer body from further descent. The drill stem and plunger shaft are allowed to descend further, causing the upward expansion of the sleeve to engage the well wall, as above described.

Method of removing packer from well

The removal of the packer from the well is accomplished by taking an upward lift upon the drill stem. This lifting motion causes the plunger shaft to move upward, and the fluid which effects the expansion of the expanding sleeve is retracted back into the barrel, causing the retraction of the sleeve inwardly away from its engagement with the well wall. As the drill stem is raised the upwardly projected sections are successively unscrewed until the packer is out of the well.

The modified sleeve construction of Figure 4

In Figure 4 I have shown the sleeve 4 formed with ears 23 projected outwardly around the circumference of the sleeve. These ears serve as a means of centering the packer as it is lowered into the well.

Construction of the sleeve

In view of the fact that the packer in many instances is required to function in contact with the oil, both as the expanding fluid within the sleeve and oil exterior to the sleeve in the well, its is important to design the sleeve so that the surfaces in contact with oil are the material capable of resisting deterioration by the solvent and/or chemical action of the oil. I therefore desire that the sleeve be covered both interiorly and exteriorly with synthetic rubber. The core of the sleeve may be constructed of rubber of high tensile strength in order that it may resist expansion either transversely or longitudinally at the points where the sleeve expands outwardly in angular directions relatively to the barrel. The sleeve is given rigidity at its top and base by the caps 7 and 12.

Where the actuating fluid in the packer and the outside well conditions are such that there is no deteriorating effect upon the rubber, the sleeve may be constructed entirely of natural rubber, and a suitable synthetic and elastic rubber may be used throughout the sleeve when desired. If desired, the sleeve may be reinforced by fabric or strips of leather or other high strength material in order to withstand high hydraulic pressure, according to known practice in hose and automobile tire casings.

In some cases it may be desirable to thread onto the gland nut 3 a dirt cap or strainer housing 26 in which is disposed a wiping material or strainer 24, so that the plunger shaft 2 as it makes its descent is wiped free of any accumulation of dirt which might be carried into the barrel.

I am aware that in known packer constructions rubber sleeves have been employed and expansion has been effected outwardly by means of a tapered mandrel forced through the center of the sleeve. Inasmuch as the sealing must be effected at all times in an uncased well hole, regardless of roughness or out-of-ground condition of the hole, and the sealing must resist the pressure differential in a satisfactory manner, such known devices have been found unsatisfactory. By means of my invention, the expanding sleeve is expanded evenly, with uniform pressure at all points of the well wall, effecting a proper seal in all cases including those where the well hole is elliptical or rough, the expanding sleeve being forced to assume the shape of the well hole by the hydraulic principle with a pressure exerted on a fluid enclosed in a vessel transmitted equally to every part of that vessel, and the total pressure exerted on the interior of the vessel is equal to the area multiplied by the pressure per unit of area.

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

An oil well packer comprising a barrel, a base flange cap carried by the barrel at its lower end, an expansible bag-like sheath surrounding the barrel and fitted within the base flange cap, the interior of the sheath communicating with the interior of the barrel, a second flange cap surrounding the sheath and into which the opposite ends of the sheath is fitted, means removably fixing the second cap to the barrel, a hollow plunger rod, a plunger head carried by the rod and projected within the barrel, a sleeve carried by the barrel at its upper end, an efflux tube passing through the plunger head and communicating with a port formed in the base cap, an apertured plug surrounding the efflux tube and threaded in the hollow plunger rod to abut said last-named packing, and an expansible liquid within the barrel below the plunger head.

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