May 7, 1935.

B. E. TYLER

2,000,109

OIL WELL SWAB

Filed Feb. 14, 1933

Fig 1

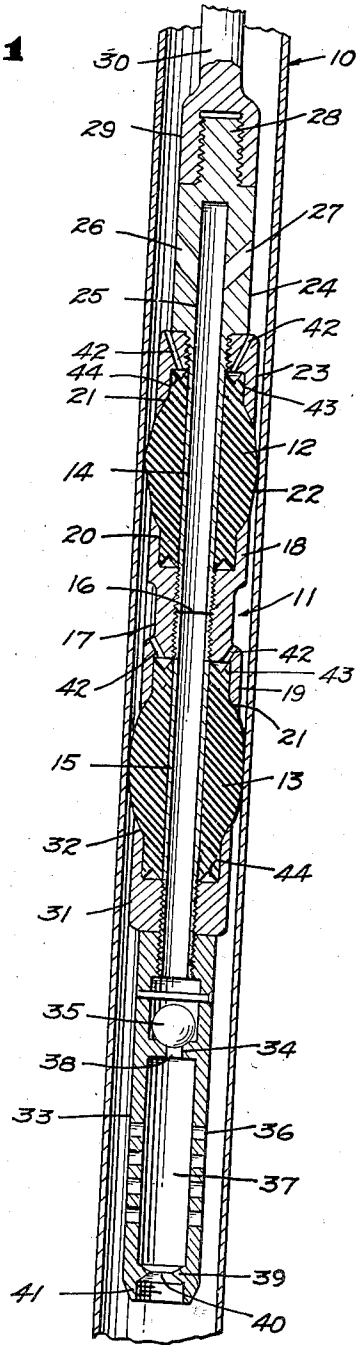
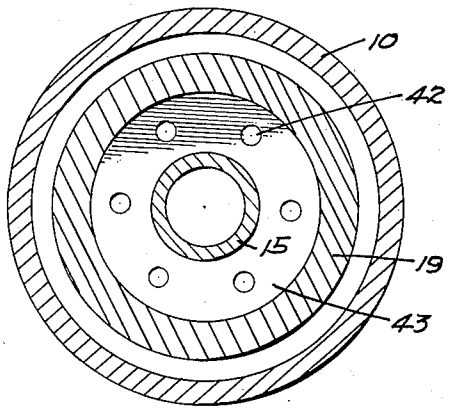


Fig 2



INVENTOR.
BERT E. TYLER.
BY James M. Abbett
ATTORNEYS.

Patented May 7, 1935

2,000,109

UNITED STATES PATENT OFFICE

2,000,109

OIL WELL SWAB

Bert E. Tyler, Los Angeles, Calif.

Application February 14, 1933, Serial No. 656,669

2 Claims. (Cl. 309—23)

This invention relates to an oil well tool, and particularly pertains to a well swab.

In oil field production operations it sometimes occurs that the well does not flow freely, although its potential production is greater than the capacity of a regular oil well pumping unit. In such cases it is often possible to obtain maximum production by a swabbing operation. The efficiency of a well swab is in direct proportion to the ability of the swab to form a tight fit between its packing elements and the surrounding wall of the well casing, and to maintain this fit irrespective of wear upon the packing elements. It is the principal object of the present invention, therefore, to provide a well swab which may be easily lowered into a well casing, and which operates by mechanical and hydrostatic pressure means to maintain a suitable packed relation with the casing at all times.

The present invention contemplates the provision of a well swab having a tubular central mandrel upon which is mounted a plurality of packing units, said units being normally set under mechanical pressure to expand against the wall of a well casing, and being provided with means to cause varying degrees of hydrostatic pressure to be imposed upon the successive packing elements to expand them into the casing so as to obtain a maximum swabbing effect even though certain of the packing units should become damaged to an extent where they would be practically useless.

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

Figure 1 is a view in central vertical section and elevation showing the well swab in position within a section of well casing.

Fig. 2 is a view in transverse section through the well swab as taken transversely of the packing cap and structure as shown in Figure 1, and as indicating the manner in which hydrostatic pressure may be imposed upon the packing element.

Referring more particularly to the drawing, 10 indicates a well casing into which a well swab 11 is introduced. The depth at which the swab is operated is determined by the condition of the well and the level of the fluid within the casing. In the drawing the swab 11 is shown as provided with a top packing rubber 12 and a lower packing rubber 13. The upper rubber is mounted upon an upper section 14 of a tubular mandrel, and the lower rubber is mounted upon the lower section 15 of a tubular mandrel. Said mandrel sections abutting against each other at 16 and being threaded into the opposite ends of a center packing cup 17. The center packing cup is formed at its upper end with a cylindrical cup member 18, and at its lower end with a cylindrical cup member 19. The cup member 18 has a center bore receiving a cylindrical extension 20 of the upper packing rubber 12. The cup member 19 has an oppositely disposed cylindrical bore receiving the upper cylindrical extension 21 of the packing rubber 13. The packing rubbers as thus described are formed at their opposite ends with longitudinally aligned cylindrical extensions 20 and 21. The intermediate portion of each of the packing rubbers is indicated at 22 as being of relatively large diameter and is preferably formed with its largest diameter intermediate its ends. The outer surfaces of the packing members are convexed longitudinally. In either event the largest diameter of the portion 22 is intended to contact with the internal face of the casing 10. In order that this contact may be firmly made, the upper extension 21 of the rubber 12 is provided with an upper cup 23 carried at the lower end of the tubular shank 24 and with which the mandrel section 14 is preferably formed integral. This upper cup has a central threaded opening to receive the upper threaded end of mandrel section 14. A central tubular passageway 25 registers with the upper opened end of the mandrel section 14 and is provided with a plurality of upwardly and outwardly inclined eduction ports 26 and 27 through which fluid may flow from the mandrel and into the well casing above the swab. The upper end of the shank 24 is formed with a pin joint 28 which may be threaded into the box joint 29 of a polish rod 30, or other suitable suspending element. The lower packing rubber 13 is provided at its lower end with a lower cup 31 which is threaded onto the lower end of the mandrel section 15. The various cups 18, 19, 23 and 31 are formed at their mouths with an inwardly inclined face 32 which engages a similar face according to the juncture between the reduced cylindrical portions of the packing elements and their enlarged central portions 22. In this manner it will be seen that by tightening the cups 23 and 31 against the adjacent ends of the packing rubbers 12 and 13, longitudinal pressure may be exerted upon the body of rubber occurring between the adjacent faces 32 of the opposed cups, thus tending to compress and deform the rubber and to cause the portions 22 to be distended to forcibly engage the wall of the casing. Either or both of the mandrel sections 14 and 15 may be secured in the center cup 17 as by welding.

The lower mandrel section 15 projects through

the threaded opening in the end wall of the lower cup 31 and into a threaded opening by a cylindrical strainer cage 33. This cage is in longitudinal alignment with the mandrel and is formed near its upper end with a check valve seat 34 receiving a check valve ball 35. The wall portion of the strainer portion of the check valve seat is formed with a plurality of upwardly and inwardly inclined ducts 36 which permit fluid to flow into a central opening 37 of the strainer and then upwardly through the valve passageway 38 beneath the ball 35.

The lower end of the opening 37 is fitted with an end wall 39 having a restricted passageway 40 through it. The areas of the passageways 36 and 40 are relatively small so that solid particles which might otherwise reach the check valve opening 38 and hold it open cannot enter the strainer and render the check valve inoperative. The strainer cage 33 terminates at its lower end in a central threaded opening 41. This threaded section may be used as a cage for a spear or fishing tool when desired.

Attention is directed to the fact that the upper cups 23 and 19 are formed with a plurality of inwardly inclined ducts 42. These ducts in each instance establish communication between the interior of the casing 10 and a chamber 43 which will occur within the cups between their end walls and the end faces of the packing rubbers 12 and 13. The end faces of the packing rubbers are preferably formed with an annular V-shaped groove 44 which circumscribes the mandrel sections, extending through the packing rubbers.

It will be recognized that when the swab is submerged in a body of liquid within the well casing, a substantial amount of hydraulic pressure will occur above the swab, and that advantage can be taken of this pressure to create a tighter joint between the packing rubbers and the internal wall of the well casing than would otherwise be possible. For this reason the ducts 42 have been provided to cause the hydrostatic pressure to act against the end faces of the rubbers 12 and 13 and thus add additional longitudinal compression to the rubbers, causing them to be distended against the wall of the casing with a force in direct proportion to the hydrostatic pressure of the liquid in which they are submerged.

It is also recognized that the burden of the load imposed upon the well swab and the internal pressure will be normally upon the lower packing rubber 13. For this reason, the cup 19 is formed with a greater number of ducts 42 than is provided for the cup 23, thus, under normal conditions there will be a greater hydraulic pressure exerted upon the lower packing rubber 13 than is exerted upon the upper packing rubber 12, and in the event that the lower packing element would tear out or be ruptured due to conditions in the well imposed upon it, it will be seen that the upper packing element would be operating under less severe conditions, and would remain normally in good condition for swabbing operations without necessitating that the swab be withdrawn from the well immediately for repairs and replacement of rubbers.

In operation of the present invention, the swab is assembled as shown in Figure 1 of the drawing, after which it is lowered to a desired depth within the fluid of the well. Prior to lowering the swab into the well the cups 23 and 31 have been properly tightened to expand the packing rubbers 12 and 13 to fit within the well casing. As the swab is lowered into the liquid of the well this expansive action will increase due to the pressure of the hydrostatic head of the liquid upon the upper ends of the packing rubbers 12 and 13 as afforded through the ducts 43 of the cups 23 and 19.

Attention is directed to the fact that when the device is assembled, the joint between the adjacent ends of the mandrel sections 14 and 15 will occur at 16 within the center cup structure 17, thus making it possible for the mandrel to be readily separated and the swab dismantled, and at the same time insuring that there will not be any leakage at a point intermediate the ends of the mandrel. As the swab is lowered into the liquid the check ball 35 will raise, thus allowing the liquid to flow into the strainer cage 33 through the openings 36 and 39, and upwardly through the central opening 38 into the mandrel comprising the longitudinally aligned sections 14 and 15. As the swab is lowered further this liquid will be free to flow outwardly through the upper end of the mandrel section 14 into the passageway 25 of the shank 24, and then outwardly through the ducts 26 and 27 into the casing. When reverse movement of the swab takes place the check ball 35 will be seated, thus entrapping all the liquid occurring in the swab and in the casing above the swab. As the swab is drawn upwardly, this liquid will be lifted from the well.

As has been previously explained, some occasions may arise where the lower packing rubber 13 will be damaged so that it would not pack off the casing, but under normal conditions the upper packing rubber will hold since the successive packing rubbers engage the wall of the well casing with progressively lighter tension toward the upper end of the swab. It will be understood that this would be true even if a greater number of packing rubbers were used than the two shown in the drawing, and that there would be no invention in assembling a plurality of mandrel sections, center cups and end caps to accommodate any desired number of packing rubbers.

It will thus be seen that the structure here disclosed, while decidedly simple as to construction will operate effectively under normal or abnormal conditions to swab a well and to maintain a properly packed condition with relation to the well casing, even though the packing rubbers should become inoperative.

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

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

1. A packing structure comprising a pair of cups mounted in opposed relation to each other, and in longitudinal alignment, each of said cups being formed with a cylindrical seat, an expansible packing member having cylindrical portions disposed in the cylindrical seats of the two cups, and an enlarged intermediate portion capable of expansion when the packing member is longitudinally compressed, the end of said expansion member being formed with a circumscribing pressure groove and the ends of the cups being formed with fluid pressure ducts communicating with said grooves whereby fluid pressure will longitudinally compress the expanding member and the edges of said end grooves will be forced out-

wardly to form a seal with the seat within the cups.

2. A packing structure adapted to be expanded into a cylindrical member comprising a central cylindrical member upon which a tubular deformable packing element is mounted, said element having an enlarged central body portion adapted to contact with the surface of the member into which it is expanded, and reduced cylinder ends, said ends having end faces formed with a circumferentially extending V-shaped groove, cylindrical cups at the opposite end of said packer and receiving the ends thereof, said cups being secured to the cylindrical member passing through the packer, whereby a compression force between the cups will tend to expand the packing, said cups being formed with ducts communicating with the grooves in the end of the packing whereby the fluid being packed will aid in producing compression of the packing.

BERT E. TYLER.