May 12, 1931. G. A. SPANG 1,804,818

WELL PACKER

Filed March 11, 1929 2 Sheets-Sheet 1

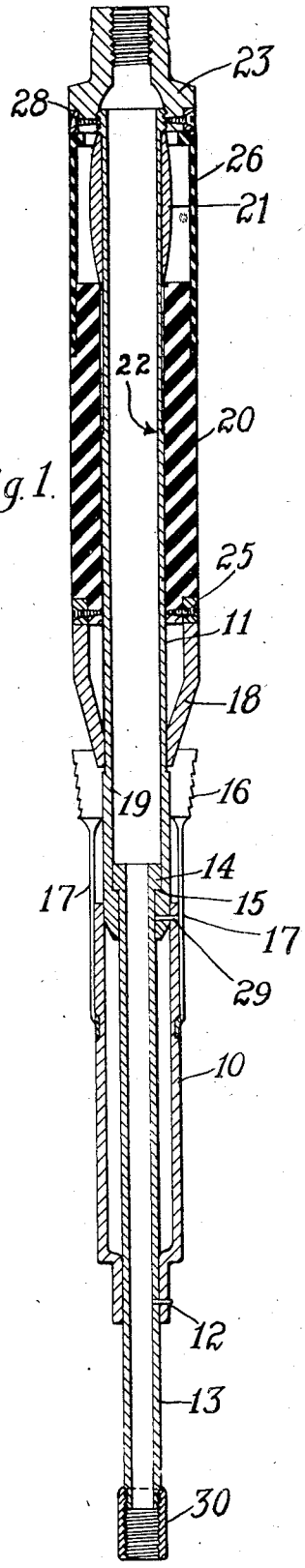


Fig. 1.

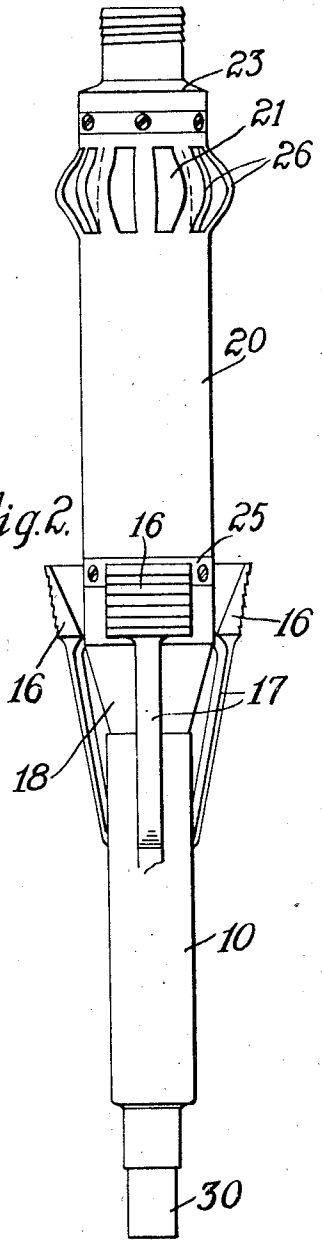


Fig. 2.

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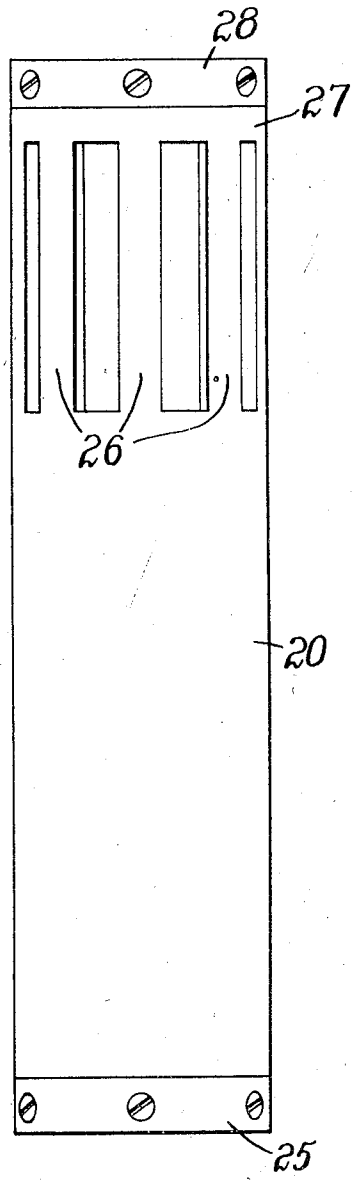


Fig.3.

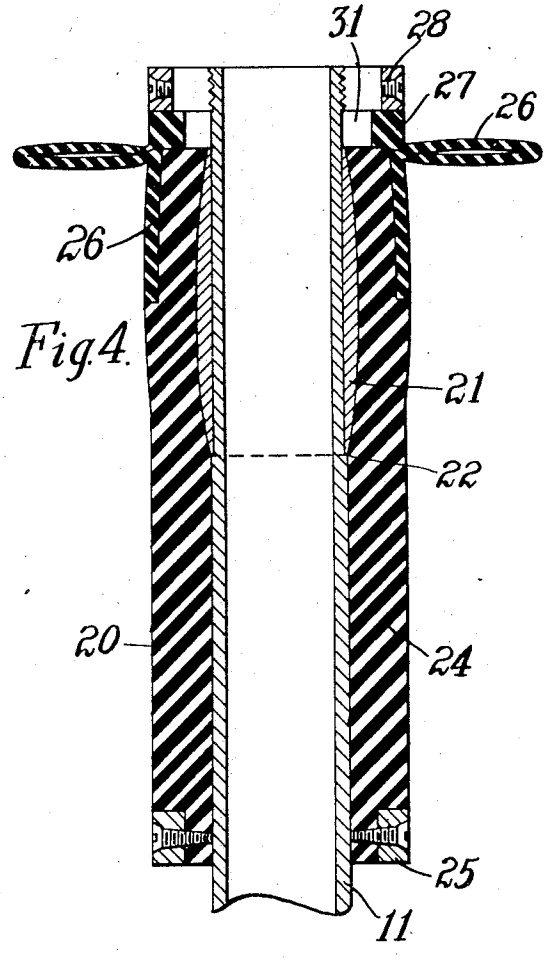


Fig.4.

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UNITED STATES PATENT OFFICE

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WELL PACKER

Application filed March 11, 1929. Serial No. 345,933.

This invention relates to well packers such as are commonly employed in connection with oil, gas, or similar wells for the purpose of sealing or packing a portion of the well against the inflow of water or other fluid into the well through the walls thereof.

Packers of this type generally include a sleeve of resilient packing material which is lowered into place and then expanded into sealing engagement with the wall of the well hole. Heretofore, the construction of this type of packers has been such that, whenever it is necessary to withdraw such a packer from the well, the withdrawing pressure is applied to the bottom of the sleeve in such a way that it tends to expand the packing into tighter engagement with the wall and the result is that the packing sleeve of resilient material is severely damaged or actually destroyed by the withdrawing operation. Packers of the type here involved are generally so constructed that the expanding of the packer sleeve is the result of contact by an actuator with the bottom of the well hole and the compression of the expander sleeve between the parts supported by such actuator and the weight of the superimposed string of pipe above the packer. It will be apparent that when the well hole is filled with loose sand, the support given the actuator may yield after the packer is in position, due to shifting or settling of the loose sand. As a result, the actuator may drop further into the well so as to deprive the packer sleeve of its support, removing the compression or expanding force from the sleeve and destroying its sealing engagement with the well wall.

An object of this invention is to provide a well packer of the type set forth constructed and arranged so as to eliminate the objectionable features above set forth.

A further object is to provide a well packer of the type set forth constructed and arranged to permit the withdrawal thereof without injuring the material of the packing sleeve.

These and other objects which will be apparent to those skilled in this particular art are accomplished by means of the invention illustrated in the accompanying drawings in which Fig. 1 is a longitudinal sectional view through a well packer constructed in accordance with one embodiment of this invention, showing the same in extended uncompressed condition for lowering into a well hole. Fig. 2 is a side elevation of the packer shown in Fig. 1, showing it in partially expanded position. Fig. 3 is a side elevation and Fig. 4 a longitudinal sectional sectional view of certain details of construction.

The particular embodiment of the present invention which has been chosen for the purposes of illustration includes a packing sleeve of resilient material which is adapted to be expanded into sealing engagement with the walls of the well hole at whatever level the leak of water, or the like, into the well occurs. The upper edge of the sleeve is provided with means for applying a pull on the sleeve at the top thereof in case it is necessary to pull the packer from the well. This pull applied to the upper edge of the sleeve causes it to be released from its sealing engagement with the wall of the well hole and contracts it sufficiently to permit its being withdrawn from the well without damage. The mechanism for expanding the sleeve is operated as a result of engagement by an actuator with the bottom of the well but mechanism is provided for supporting the packer in place in the well, in expanded wall sealing position, even though the support of the well bottom may be lost as a result of shifting or settling sand, or the like.

As illustrated, the well packer includes an outer tube 10 slidably mounted on the lower portion of an intermediate tube 11 and connected at the bottom by a breakable pin 12 to an inner tube 13 which is slidably received in the lower end of the intermediate tube 11 and held from separation therewith by the upset end 14 of the inner tube engaging a shoulder 15 formed on the inside of the intermediate tube 11. Wall gripping slips 16 are located above the outer tube 10 to which they are connected by reins 17 welded or otherwise secured to the tube. A cooperating slip expanding cone 18 is slidably mounted on

the inner tube 11 and is held against downward movement thereof by a suitable annular shoulder 19 engaging the lower edge of the cone.

An expansible well packing sleeve 20 of rubber or other suitable material is loosely mounted on the intermediate tube 11 above the cone 18 and a sleeve expander 21 is positioned around the intermediate tube above the top edge of the expander sleeve 20 so as to expand the latter into sealing engagement with the wall of an associated well when forced downwardly into the sleeve. The expander is of double cone shape being thicker near the center of the body than at either end and it is positioned between the shoulder 22 on the intermediate tube and the bottom surface of a packer head 23 secured to the upper end of the intermediate tube.

As heretofore pointed out, one of the features of the present invention is a construction permitting the tool to be pulled out of the well without damaging the packing sleeve. As illustrated, the sleeve 20 has a body portion 24 of tough resilient packing material with a metal ring 25 molded into the bottom edge so as to constitute an integral part thereof. A plurality of non-resilient strips 26 extend upwardly above the upper edge of the body portion 24 and have a considerable portion thereof molded into the body portion and extending downwardly therein a substantial distance so as to provide a secure connection union of the straps with the packing.

The upper ends of the straps are molded into a rubber ring 27 which in turn is molded on and forms a part of a metallic ring 28 similar to the bottom ring 25 by means of which the straps are secured to the tool head 23.

When the well packer is lowered into the well hole, the parts are in the position shown in Fig. 1 and the outer tube 10 is held in place at the bottom of the intermediate tube 11 by a breakable pin 29. In this position, the slips 16 are contracted and do not engage the wall of the well hole. It will be apparent that the initial seating of the illustrated packer results from engagement of the inner tube 13 with the bottom of the well hole. It will also be understood by those skilled in the art that the point in the well hole at which the leak occurs and its distance above the well bottom as first definitely ascertained in the usual way and sufficient tubing is connected to the lower end of the tool by a suitable connection 30 so that when the bottom of such tubing contacts with the bottom of the well, the packing sleeve 20 will be at the proper height to seal the wall of the well against the inflow of water or other fluid.

Assuming that the requisite length of tubing has been connected to the bottom of the inner tube 13 by means of the connecting sleeve or union 30, and assuming that the parts are in the relative positions indicated in Fig. 1, the packer head 23 is connected to the bottom of the usual string of pipe and lowered into the well hole. When the tubing connected to the bottom of the inner tube 13 engages the bottom of the well hole further movement of the inner tube 13 is prevented. The weight of the string of pipe on the packer head 23 and intermediate tube 11 presses the latter downwardly. The pin 12 connecting the outer tube 10 to the inner tube 13 is sheared off and the outer tube 10 moves downwardly into engagement with the union 30 as illustrated in Fig. 2. Further downward movement of the outer tube 10 and the associated wall engaging slips 16 is prevented thereby, but the weight of the string of pipe continues to press the intermediate tube 11, packing sleeve 20, and slip-expanding cone 18 downwardly until the lower edge of the cone rests on the upper edge of the outer sleeve 10, as illustrated in Fig. 2. In this position the slips 16 are expanded outwardly into packer supporting engagement with the adjacent wall of the well hole. The pressure of the string of tools continues to move the packer head 23 and intermediate tube 11 downwardly after the downward movement of the cone 18 has stopped so as to force the sleeve expanding cone 21 downwardly into the packing sleeve 24 as shown in Fig. 4. The driving of the expander cone into the sleeve and the pressure on the sleeve between the lower ring 25 and the packer head 23 causes the material of the ring to spread outwardly into sealing engagement with the surrounding wall of the well hole. It will be understood, of course, that the strips 26 fold upon themselves in such a way as to permit the upper ring 27 to engage the upper edge of the body portion 24 of the expander sleeve as diagrammatically illustrated in Fig. 4, although when in the well hole, the flexible strips cannot extend outwardly in the manner shown in that figure. The conical upper end of the expander 21 permits the material at the upper end of the body portion 24 to contract around the upper end thereof so as to effectively seal the opening 31 within the ring 27 and prevent leakage therethrough.

The slips 16 engage the wall of the well in such a way as to themselves form a support for the packer with the result that even if the inner tube 30 is lowered by any settling of loose sand or the like in the well bottom, the pressure on the expander sleeve 20 and support of the packer in position will be maintained through the medium of the expanded wall engaging slips 16.

It is for this purpose that the connection between the outer tube 10 and the inner tube 13 is a breakable connection, such as the pin 12 described and illustrated. It will be apparent that, if a solid joint were provided

between these tubes, any lowering of the inner tube 13, resulting from settling of the well bottom, would draw the outer tube 10 with it and permit the packer supporting slips 16 to contract. This possibility is eliminated by the provision of a breakable connection between the slips and the actuator. In effect, after the packer is set in packing position, the arrangement permits a considerable amount of lost motion between the actuator or inner tube, with its connected tubing, the outer slip-supporting tube, to permit the actuator to settle without affecting the engagement of the packer with the wall.

In case it becomes necessary for any reason to pull the packer from the well, the pull is first exerted upon the packer head 23, the upward movement of the packer head causes the intermediate tube 11 to move upwardly and this forces the expander cone 21 out of the sleeve 20. At the same time the upward movement of the packer head 23 exerts a pull upon the non-flexible strips 26 connecting the packer head to the upper end of the body portion 24 so that tension is applied to the latter which results in its being withdrawn or pulled out of the well without damage. The upward movement of the intermediate tube 11 withdraws the expanding cone 18 from the slips 16 so that the latter may contract and free themselves from engagement with the wall of the well hole. In case any of the slips are in such engagement with the well wall that they cannot free themselves therefrom, withdrawal of the tool will cause the slips to fold downwardly adjacent the outer face of the outer sleeve 10. The outer sleeve 10 being of considerably smaller diameter than the well hole, sufficient space is provided adjacent the sleeve for the folded slips 16 and the entire tool can be pulled out of the well without difficulty. It will, of course be understood that lifting of the tool moves the inner tube 13 downwardly until the upset end 14 thereof engages the shoulder 15 inside the intermediate tube 11 after which the entire device including the connected tubing (not shown) is removed.

Although I have described a particular form of well packer in more or less detail, it will be apparent that various changes, additions, omissions and substitutions can be made therein without departing from the spirit of this invention or the scope of the appended claims.

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

1. A well packer having in combination a tube, a sleeve of resilient well packing material thereon, means on said tube for expanding said sleeve into sealing engagement with the wall of the well hole, packer supporting slips adapted to engage said wall for supporting said packer in position and an actuator slidable within said tube, adapted to be operated by engagement with the bottom of the well hole for simultaneously operating said expanding means and said slips.

2. A well packer having in combination a tube, a sleeve of well packing material thereon packer supporting slips adapted to be moved into wall engaging position for supporting said packer in said well, means slidable in said tube operated by engagement with the bottom of the well for actuating said slips and means permitting relative movement of said actuator with relation to said slips after said slips are in packer supporting position.

3. A well packer having in combination a packing sleeve loosely mounted on a sleeve, means for engaging the wall of a well hole for supporting said packer therein, an actuator for operating said supporting means upon engagement with the bottom of the well hole and a breakable connection between said actuator and said supporting means permitting said actuator to move without affecting said supporting means after said supporting means is in packer supporting position.

4. A well packer having in combination a plurality of supporting slips for supporting said packer on the wall of the associated well hole, an expanding cone, an actuator operable upon engagement with the bottom of the well hole for causing relative movement between said slips and said cone so as to expand said slips into packer supporting position, and a breakable connection between said actuator and said slips to permit movement of said actuator relative to said slips after said slips are in packer supporting position.

5. In a well packer, an intermediate tube, a sleeve of resilient material thereon, flexible straps connecting said sleeve with the top of said tube, an outer tube slidably mounted on said first mentioned tube, wall engaging slips on said outer tube for supporting said packer in a well hole, means on said intermediate tube for circumferentially expanding said sleeve, means slidable within said intermediate and outer tube for expanding said slips when in engagement with the bottom of the well, and breakable connections joining said slip actuating means and said outer tube for permitting relative downward movement of the actuating means when the slips are in the packer supporting position.

6. In a well packer, a tube, a sleeve of resilient packing material thereon, means for circumferentially expanding said sleeve, an outer tube slidable over said first mentioned tube, a plurality of slips on said outer tube adapted to expand and to support said packer in a well hole, an inner tube slidable within said first mentioned tube adapted to expand said slips on engagement with the bottom of the well, breakable connections between said tubes for permitting relative downward movement of the inner tube when the slips are

in wall engaging position and means for contracting said slips and said packing sleeve for withdrawing said packer from the well.

7. A well packer comprising a tube, a packer sleeve loosely mounted thereon, an actuator slidable within said tube, an outer tube slidably mounted on said actuator, a plurality of wall engaging slips on said outer tube, a breakable pin connecting said outer tube and said actuator and means on said first mentioned tube for expanding said slips and said packer sleeve when said actuator is in engagement with the bottom of the well.

In testimony whereof, I have hereunto subscribed my name this 7th day of March, 1929.

GEORGE A. SPANG.