

Feb. 6, 1934.

L. A. LAYNE

1,945,943

HYDRAULIC SETTING TOOL

Filed April 5, 1932

2 Sheets-Sheet 1

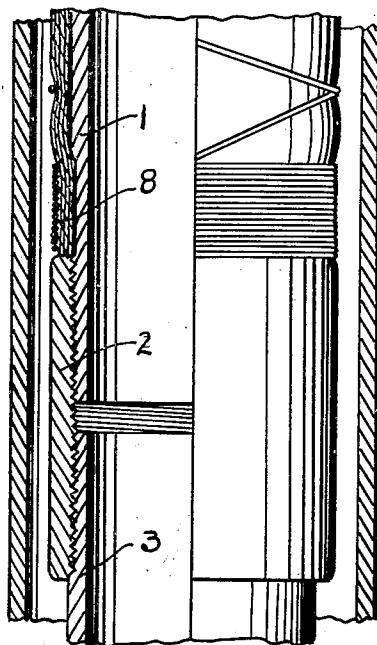
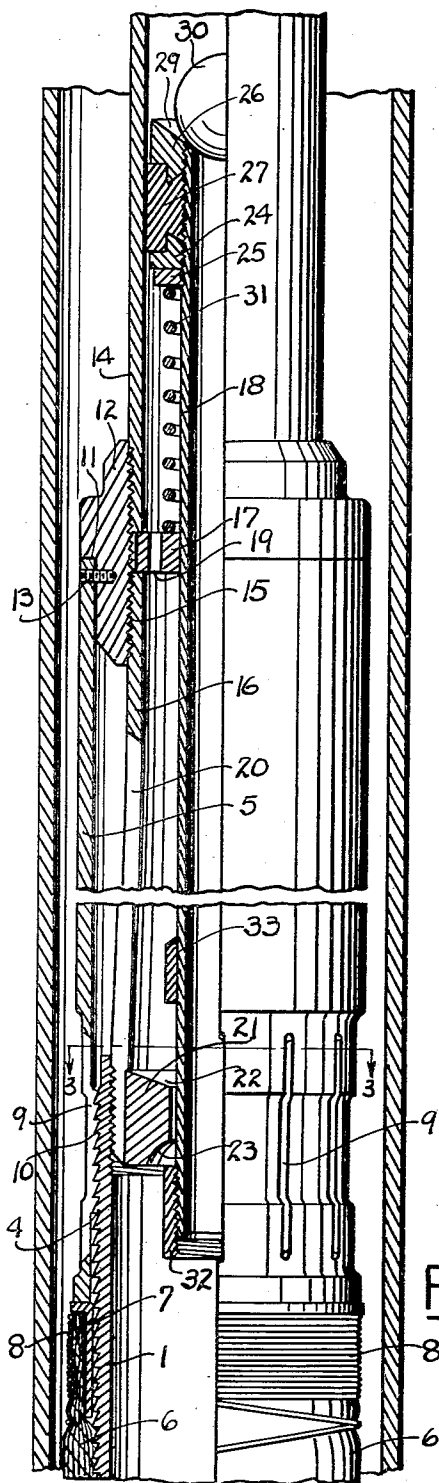


Fig. 2.

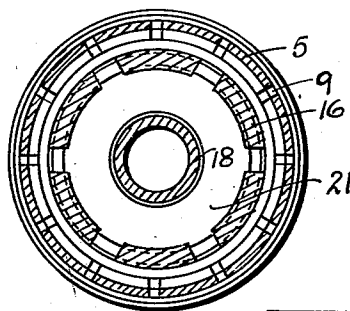


Fig. 3.

Fig. 1. Leslie A. Layne Inventor

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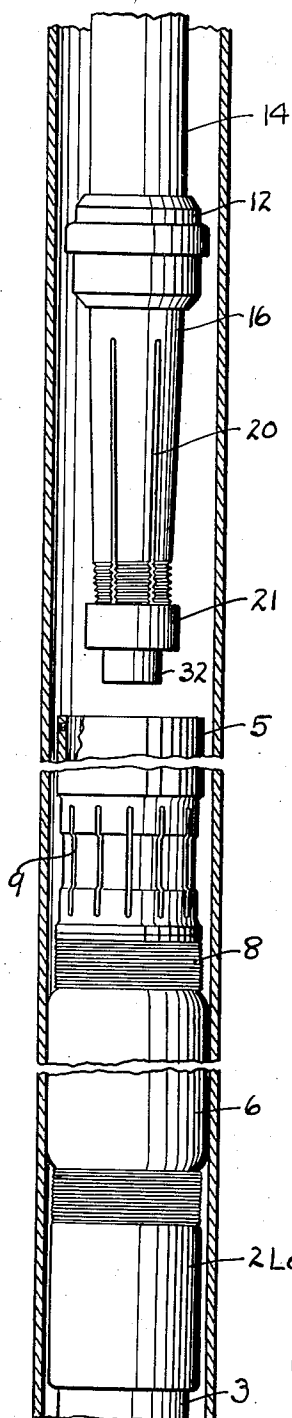
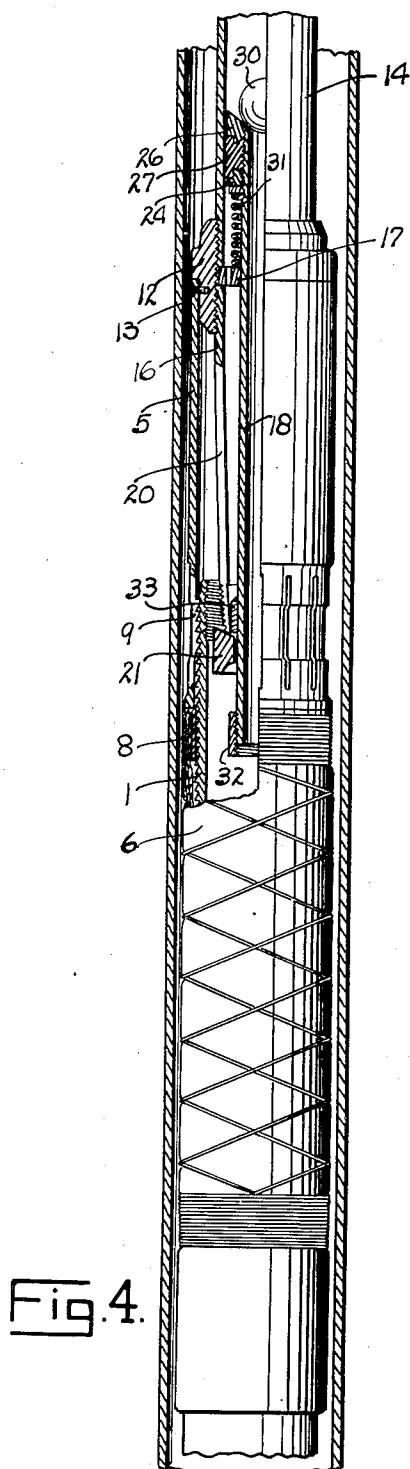
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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HYDRAULIC SETTING TOOL

Leslie A. Layne, Houston, Tex.

Application April 5, 1932. Serial No. 603,351

12 Claims. (Cl. 166—10)

My invention relates to setting tools which may be employed in setting packers, screens, liners and the like, in deep wells.

In finishing a well for production it is usually customary to set packers and the like in the casing for closing off the passage of liquid between the casing and the liner or screen. These packers must be introduced into the well from the surface to the point where the packer is to be expanded, and the setting operation must then be accomplished and the setting tool withdrawn from the well. Setting tools now used most commonly are constructed so that the setting tool may be released by unscrewing the setting tool from the packer. This unscrewing action is to be avoided where possible for it is frequently necessary to rotate the string of pipe to clear the tool when it gets hung up while going into the well. If this is done, however, the result will be that the packer is unscrewed and released and will be expanded thereafter by the lowering of the stem in an undesirable place in the well.

It is an object of my invention to provide a setting tool which may be released from the packer or liner without the necessity of rotation of the pipe.

I desire to form a setting tool which may be rigidly engaged with the pipe or liner to be set in the well but which may be released by hydraulic pressure exerted upon the apparatus when release is desired.

I contemplate the provision of a setting tool through which flushing fluid may be pumped during the setting operation, but which will permit the closing of the passage of fluid through the device so as to perform the operation of the releasing mechanism, but which will be unaffected by the rotation of the setting stem.

In the drawings herewith I have shown a preferred form of the device as connected with a packer it being understood, however, that the tool may be employed for setting other devices.

In Fig. 1 is shown partly in section and partly in longitudinal elevation, a setting tool embodying the invention and disclosing particularly the setting tool and the upper end of the packer.

Fig. 2 is a similar view showing the lower end of the packer attached to the liner or screen.

Fig. 3 is a transverse section taken on the plane 3—3 of Fig. 1.

Fig. 4 is a side elevation showing the setting tool connected with the packer, part of the setting tool being broken away for greater clearness.

Fig. 5 is a similar view showing the setting tool released from the packer.

The packer which is illustrated in combination with my invention may be one of ordinary construction. I have shown a packer barrel 1 connected by means of a coupling 2 at its lower end with the liner or other pipe 3. The outer surface of the packer barrel toward its upper end is provided with a downwardly inclined ratchet thread 4 thereon for engagement with the expander sleeve 5. The packer comprises a series of windings of canvas 6 about the barrel and between the coupling 2 and the upper end of the barrel. A sliding collar or nipple 7 at the upper end of the packer serves as a seat upon which the windings of canvas are attached by means of wire 8 wound about the canvas in the usual manner.

The expander or packer sleeve 5 is slotted as shown at 9 adjacent the lower end, and the wall of the sleeve is depressed inwardly to bear against the outer face of the packer barrel. It is formed with teeth 10 thereon to engage the ratchet teeth upon the barrel and allow relative downward movement of the packer sleeve to move the packer downwardly, but which will prevent the relative upward movement of the sleeve on the barrel. The slotting of the sleeve allows resiliency of the sleeve relative to the barrel in operation.

The upper end of the expander sleeve is fitted within a recess 11 in the bushing 12 and is secured detachably thereto by means of a shear pin 13 which is of material easily broken by an upward pull upon the bushing.

The bushing 12 is threaded at its upper end for attachment to the drill stem 14 by means of which the setting tool is handled. The lower end of the bushing is threaded on its interior at 15 for attachment to the connecting sleeve 16. Between the drill stem and said connecting sleeve within the bushing is placed a stop ring 17 which fits closely about an interior setting barrel 18. It is provided with longitudinal openings 19 to allow the passage of fluid therethrough.

The connecting sleeve 16 spaces the bushing 12 above the packer barrel. It is slotted longitudinally at 20, said slots extending from the lower end to a point spaced slightly from the upper end thereof so that the lower end of the sleeve may be expanded outwardly to engage with the inner surface of the packer barrel. The engaging surfaces of the packer barrel and the connecting sleeve are threaded for a close engagement between the two. The lower end of the

connecting sleeve is expanded outwardly to engage said sleeve with the packer barrel by means of a wedge ring 21.

The ring 21 is of a predetermined external diameter to engage the lower end of the connecting sleeve and hold it firmly in contact with the packer barrel. It is slidable downwardly relative to the connecting sleeve and may be driven from position therein by a blow from the setting barrel. The upper end of the ring 21 is provided with a downwardly tapered seat 22 and the lower end is also cut away at 23.

The setting barrel 18 has a packing member at its upper end which is made in the form of a piston. Said piston includes a lower plate or ring 24 threaded on the outer surface of the setting barrel and located in position by a lock ring 25. There is an upper plate or ring 26, said plates 26 and 24 being formed to engage between them a packing member 27 which is preferably of rubber or other flexible composition, the outer periphery of which contacts closely with the inner wall of the drill stem. The upper end of the piston has an inwardly tapered seat 29 adapted to receive a ball valve 30 which is dropped into position when desired, as will be later explained.

The setting barrel 18 is held in position within the drill stem by means of a spring 31 which bears at its lower end upon the plate 17 and at its upper end upon the ring 25.

At the lower end of the setting barrel is a collar 32 which is large enough to engage against the lower end of the wedge block 21 when the drill stem is elevated in withdrawing the tool from the well. Above the wedge block 21 upon the setting barrel is a ring 33 which is welded rigidly to the setting barrel and is adapted to strike a blow upon the upper end of the wedge block 21 in operation.

When the device is introduced into the well the parts are assembled as shown in Figs. 1 and 2. The ball valve 30 at the upper end is, however, not in place but is retained at the surface. When the packer is being introduced into the well it is frequently necessary to wash down through the interior of the drill stem and the packer barrel and remove material from the interior of the casing. When the packer is in position to be set, however, the setting tool is released through fluid pressure.

Should it become necessary to rotate the string to clear away material tending to obstruct the lowering of the tools, or should the pipe become hung up for any reason, the stem may be rotated without danger of affecting the packer in any way.

The setting operation is performed by dropping the valve 30 from the upper end of the drill stem downwardly through the liquid therein to hit upon the seat 29 and close the passage through the setting barrel. Water may then be pumped downwardly in the drill stem and the piston will then function to move the setting barrel downwardly to bring the ring 33 thereon against the wedge block 21 and move it downwardly from within the connecting sleeve 16 thus allowing the lower end thereof to contract and move away from its engagement with the packer barrel 1. This release of the connecting sleeve from the packer barrel will allow the drill stem and bushing 12 to move downwardly relative to the packer barrel and the expanding sleeve 5 will be moved slidably down over the packer barrel and will compress the packer longitudinally and expand it laterally against the casing.

In Fig. 4 the tool is shown in position after the wedge block 21 has been forced downwardly out from the lower end of the connecting sleeve. The parts in that position are ready to allow the weight of the drill stem to rest upon the expanding sleeve 5 and force the packer into contracted position as shown in Fig. 5. When the packer has been properly expanded an upward pull may be exerted upon the drill stem sufficient to shear the pin 13 and allow the setting tool to be moved upwardly away from the packer as shown in Fig. 5 and allow the same to be withdrawn from the well.

When the water pressure is released from the setting tool the spring 31 will raise the setting barrel 18 upwardly and the wedge block 21 will be carried up to engage the upper flared end thereof against the lower end of the connecting sleeve and hold the lower end thereof inwardly so that it will not interfere with the withdrawal of the tool from the well.

The advantages of my tool lie in the ease with which it is operated and through the fact that no rotation of the tool during its operation is necessary at any time. No unscrewing of parts is necessary or desirable in its operation. Furthermore, it is easily and positively released when the setting has been accomplished and it may be withdrawn from the well without difficulty due to the automatically collapsed position which it assumes when the packer has been set. It is a practically simple and easily operated tool and will be safe and effective in use.

The fact that the tool may be rotated without affecting the packer is of advantage because the lower end of the string may be equipped with drilling tools where desirable enabling drilling to be done before setting the packer and no damage to the packer will result.

Having described my invention, what I claim is:

1. A setting device including, a packer barrel, a packer sleeve slidable thereon, a stem, a bushing thereon, means to space said bushing from said packer barrel, means to hold the lower end of said spacing means in connection with said packer barrel, and hydraulically operated means to release said connection and allow said bushing to move said packer sleeve downwardly.

2. A setting device including, a packer barrel, a packer sleeve slidable thereon, a stem, a bushing thereon, means to space said bushing from said packer barrel, means to hold the lower end of said spacing means in connection with said packer barrel, and means operable by downward longitudinal movement alone to release said connection and allow said bushing to be moved relatively downward toward said packer barrel.

3. In a setting device, the combination of a tubular member, a drill stem, a bushing thereon, a sleeve spacing said bushing from said member, means to expand said sleeve into rigid engagement with said member, and means actuated by hydraulic pressure to move said first mentioned means and release said sleeve and bushing.

4. In a setting device, the combination of a tubular member, a drill stem, a bushing thereon, a sleeve spacing said bushing from said member, means to expand the lower end of said sleeve to hold it connected with said member, and a setting barrel slidable in said stem, and adapted to be forced downwardly without rotation to move said expanding means and release said sleeve and bushing.

5. In a setting device, the combination of a tubular member, a drill stem, a bushing thereon,

a sleeve spacing said bushing from said member, means releasable from said member to connect said member and said sleeve, and hydraulically operated means slidable in said drill stem to disconnect said sleeve from said member to allow said bushing to be moved downwardly.

6. In a setting device, a packer barrel, a packer-expanding sleeve thereon, a drill stem, a bushing thereon above said sleeve, a connecting sleeve between said bushing and said barrel, means to retain the lower end of said connecting sleeve engaged with said barrel, a setting barrel slidable within said drill stem and adapted when moved downwardly to move said sleeve-retaining means and allow said bushing to be moved downwardly on to said packer expanding sleeve.

7. In a setting device, a packer barrel, a packer-expanding sleeve thereon, a drill stem, a bushing thereon above said sleeve, a connecting sleeve between said bushing and said barrel, means to retain the lower end of said connecting sleeve engaged with said barrel, a setting barrel slidable within said drill stem and hydraulically-operated means fixed on said setting barrel and adapted when moved downwardly to move said sleeve-retaining means and allow said bushing to be moved downwardly on to said packer-expanding sleeve.

8. In a setting device, a packer barrel, a packer-expanding sleeve thereon, means to prevent upward movement of said sleeve on said barrel, a drill stem, a bushing thereon engaging said sleeve, means to prevent downward movement of said bushing to move said sleeve, and means actuated by fluid pressure and slidable longitudinally in said drill stem to release said first mentioned means and allow said bushing and sleeve to be moved downwardly on said barrel.

9. In a setting device, a tubular member, a drill stem, a connecting sleeve between said stem and said member, the lower end of which is expandable, means to expand said lower end and hold said sleeve engaged with said member, and hydraulically operated means to move said holding means and allow said stem to be moved relative to said tubular member.

10. In a setting device, a tubular member, a drill stem, a connecting sleeve between said stem and said member, the lower end of which is expandable, means to expand said lower end and hold said sleeve engaged with said member, and a setting barrel slidable in said drill stem and actuated by pump pressure to move said holding means to allow said lower end to contract and allow said stem to be moved relative to said tubular member.

11. In a setting device, a tubular member, a setting stem, a connecting sleeve engaged with said stem the lower end of which is slotted, means to expand said lower end into rigid engagement with said tubular member, a setting barrel in said stem, a piston thereon whereby fluid pressure may move said setting barrel downwardly and remove said expanding means to release said connecting sleeve from said tubular member.

12. In a setting device, a packer barrel, a setting stem, a connecting sleeve on said stem, means to engage said sleeve with said barrel including a wedge block within said sleeve, a tube slidable in said stem and operable by hydraulic pressure, and means on said tube comprising an abutment engaging said wedge block to release said sleeve engaging means from said barrel.

LESLIE A. LAYNE.

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