

Sept. 7, 1937.

C. C. BROWN

2,092,048

PACKER SETTING DEVICE

Filed June 18, 1936

2 Sheets-Sheet 1

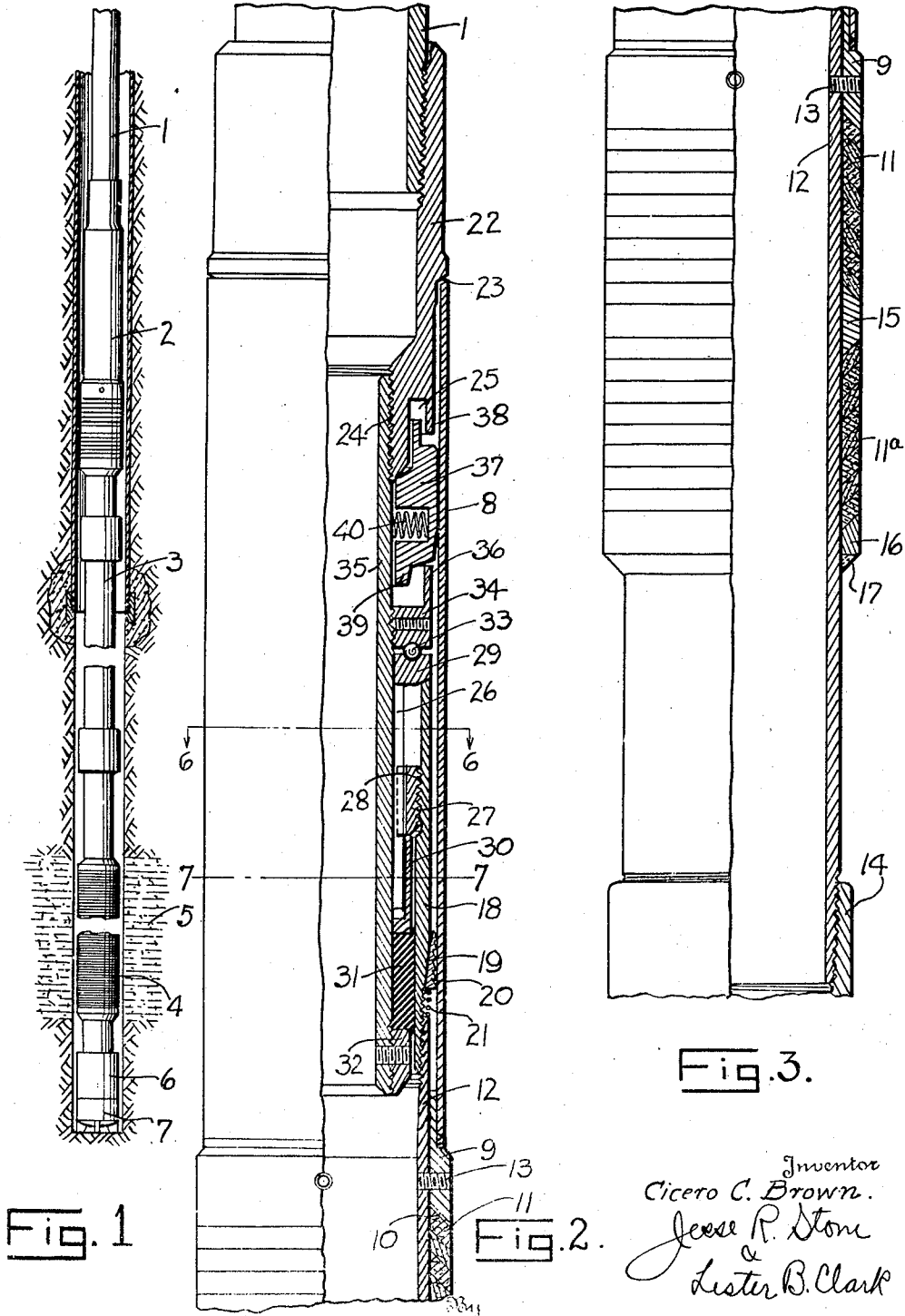


Fig. 3.

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2 Sheets-Sheet 2

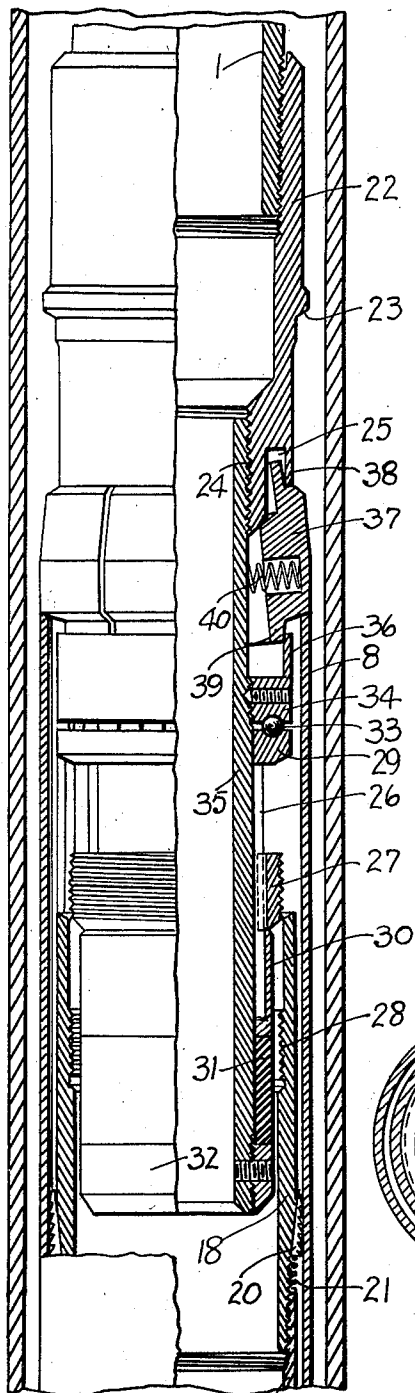


Fig. 4.

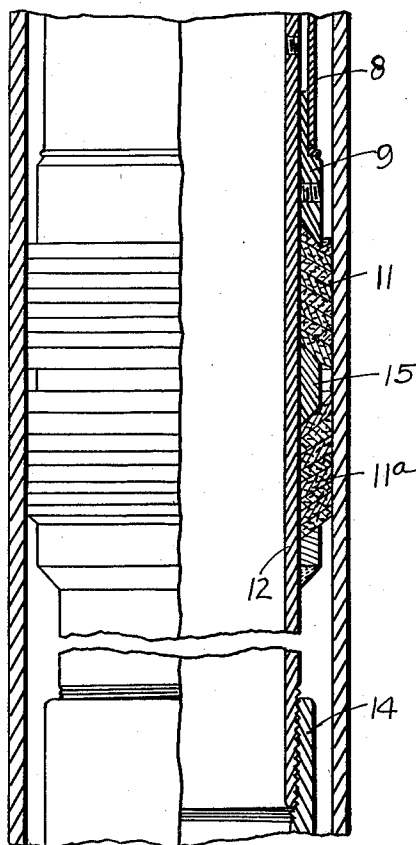


Fig. 5.

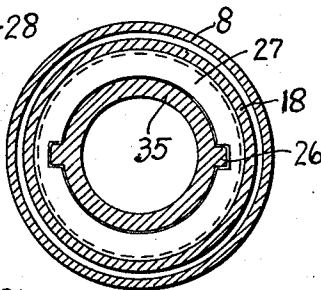


Fig. 6.

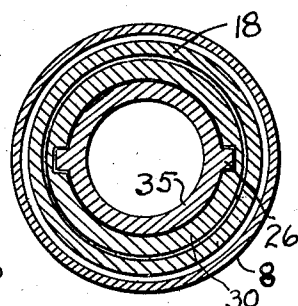


Fig. 7.

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2,092,048

PACKER SETTING DEVICE

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Application June 18, 1936, Serial No. 85,904

6 Claims. (Cl. 166—10)

My invention relates to devices for setting packers and liners in wells.

It is an object of the invention to provide a setting device for lowering screens, liners, and the like into the well and for thereafter setting a packer above the same and to so construct such device that it is not liable to be disconnected in the setting operation and which may, however, be easily disconnected when desired.

It is an object of the invention to provide a threaded connection between the setting string and the packer operating mechanism which will be readily unscrewed and released without danger of binding or breaking so that the operation will be easily controlled from the surface.

It is a further object of the invention to provide a packer which can be readily expanded and form a positive seal with the interior of the casing when the liner has been properly seated and the screen washed.

I further desire to provide a setting device which will form a close seal with the packer mechanism upon the liner and allow circulation through the string without danger of leaking around the upper end of the liner.

The invention lies largely in the structure and arrangement of the parts which allows for a firm connection between the setting string and the packer or liner while the parts are lowered into the well but which are readily and accurately released when the setting operation is performed.

With reference to the drawings herewith, Fig. 1 is a longitudinal section through a well bore showing the assembled setting device, packer and screen in position in the well.

Fig. 2 is a side view partly in elevation and partly in central longitudinal section showing the connection between the setting string and the upper end of the packer.

Fig. 3 is a similar view showing the construction of the packer.

Fig. 4 is a view similar to that shown in Fig. 2 but illustrating the parts in packer setting position.

Fig. 5 is a view partly in elevation and partly in section showing the packer in expanded or set position.

Fig. 6 is a transverse section on the plane 6—6 of Fig. 2.

Fig. 7 is a transverse section on the plane 7—7 of Fig. 2.

It is customary in finishing a well to drill down to a point somewhat above the producing stratum and to cement the casing in the well. The well is then drilled down through the cement and on

ahead into the producing formation. After the well has been thus drilled ahead, the strainer and liner are lowered into position through the casing, and after the well has been washed a packer is set to close off the space between the liner and the interior of the casing. My invention is concerned with the setting string by means of which the liner and strainer are positioned and the packer expanded into sealing position at the upper end of the liner.

In Fig. 1 I have shown how the parts of the assembly are connected for insertion into the well. The assembly is connected at the lower end of a string of pipe 1 which may be a tubing or drill stem, the assembly consisting of a packer 2 for sealing between the casing and the liner, a string of liner 3 below the packer and a strainer 4 in the well adjacent the producing formation 5. The strainer usually has a back pressure valve housing 6 and a set shoe 7 at the lower end thereof.

My invention is connected particularly with the packer and the connection between the same and the setting tool. With reference to Fig. 2, it will be seen that the packer includes an upper setting sleeve 8 connected at its lower end to a setting collar 9, the lower end of which is beveled off at 10 to fit above a series of packing rings 11 of compressible material. The collar 9 is slidable over an inner packer barrel 12 to which it is detachably connected by a shear pin 13. The lower end of the packer barrel is connected by means of the coupling 14 with the liner.

The packing rings are arranged in upper and lower sets, the upper set of packing rings being inclined outwardly and downwardly, the lower set 11a being inclined upwardly and outwardly. There is a spacing ring 15 between the two sets of packing rings and below the lower set is a supporting ring or collar 16 welded to the outer surface of the packer barrel as shown at 17. The packing rings may be of flexible and compressible material of the desired composition and are adapted to be expanded outwardly by longitudinal compression, the spacing ring 15 being slidable on the packer barrel.

At the upper end of the packer barrel is connected a setting nipple 18 the lower end of which nipple is reduced in outer diameter for engagement with the packer barrel 12 and above the reduced portion is a downwardly tapered seat 19 upon which is placed a plurality of pipe engaging dogs 20. Said dogs are cylindrical on their outer faces and have downwardly inclined teeth thereon to engage with the setting sleeve 8 and prevent

relative upward movement of said sleeve on the nipple 18. Said dogs are urged resiliently upwardly by a compression spring 21 bearing at its lower end against the upper end of the packer barrel 12.

The setting tool which engages with the upper end of the packer assembly is connected directly with the lower end of the setting string 1. It includes an upper collar 22 which is adapted to extend downwardly within the upper end of the setting sleeve 8. It has an outwardly extending flange on the lower side of which is a shoulder 23 to engage against the upper end of the setting sleeve and limit the relative downward movement of the setting tool therein. On the lower end of the collar 22 the interior diameter is decreased and the collar has a threaded engagement at 24 with the upper end of the setting mandrel 35. The lower extremity of the collar 22 is formed with an annular recess extending upwardly from the lower end, as shown at 25, thus providing a channel into which the upper ends of the setting dogs 37 may be engaged.

The outer surface of the mandrel is formed at 26 with a radial rib or key. This key has a slidable but non-rotatable connection with a locking collar 27, which is threaded on its outer face to engage at 28 with the inner wall of the setting nipple previously noted. It has a keyway on its inner surface to receive the key 26.

Said setting nipple has its upper end bearing against the ring 29 which fits against the outer surface of the setting mandrel. The nipple is extended downwardly in spaced relation to the setting barrel and is connected, as previously noted, with the upper end of the packer barrel.

The connection between the locking collar 27 and the setting nipple is a lefthand threaded connection so that when the mandrel is rotated in a righthand direction the locking collar will be screwed upwardly from connection with the setting nipple. Between the locking collar 27 and the lower end of the mandrel is a spacing sleeve 30 and a packing sleeve 31. Said packing sleeve is of rubber or other compressible material and is seated at its lower end upon a ring or nut 32 secured against rotation upon the lower end of the setting nipple. The spacing sleeve 30 is adapted to exert a downward pressure upon the packing collar 31 where said collar 27 is screwed down and compress the same so as to seal between the lower end of the setting tool and the interior of the packer.

At the upper end of the ring 29 is a raceway within which a row of balls 33 may be placed. These balls form an anti-friction bearing between the setting nipple and a collar 34 screwed upon the outer surface of the mandrel 35, said collar having an upwardly projecting outer flange 36 to limit the outer movement of the setting dogs 37.

These setting dogs 37 are mounted loosely on the outer surface of the mandrel. They have upwardly projecting reduced ends 38 to engage within the recess 25 in the collar 22. They thus have a loose connection at their upper end but are limited in their movement outwardly away from the mandrel. The lower ends of the setting dogs 37 have downward projections 39 engaging within the flange 36 on the collar 34. They are thus loosely mounted at their lower ends but are limited in extent of outward movement. There is a coil spring 40 housed on the inner side of each of the setting dogs which tends to hold the

dogs normally outwardly in contact with the interior of the setting sleeve 8.

The assembly, as shown in Fig. 1, will be secured at the lower end of the setting string by the engagement illustrated in Fig. 2. The lower end of the setting string with the packing sleeve 31 thereon connected in position as shown in Fig. 4 will be lowered within the upper end of the setting nipple and the mandrel will be rotated to screw the locking collar 27 downwardly into threaded engagement with the setting nipple at 28. This downward screwing of the clamping collar will bring the lower end thereof into engagement with the spacing sleeve 30 and will thus expand the packing 31 into sealing position, as shown in Fig. 2. During this rotation of the parts the weight of the setting string will be supported by the contact of the collar 34 upon the anti-friction bearings 33. There will be no weight bearing on the clamping collar 27.

In this position the whole assembly may be lowered into the well and when the strainer has been set upon the bottom the outer portion of the well may be washed in the usual manner and then the packer will be set. This will be done by disengaging the setting tool from the upper end of the setting nipple. To do this the setting string is rotated in a righthand direction. The key 26 on the mandrel engaging within the locking collar 27 will screw the collar upwardly away from connection with the setting nipple. This will release the pressure on the spacing sleeve 30 and the packing collar 31, allowing the packing to contract and release from engagement with the interior of the setting nipple. The parts may be then drawn upwardly into the position shown in Fig. 4 with the dogs 37 above the upper end of the setting sleeve 8. The spring will force the dogs outwardly so that when the setting tool is then moved downwardly the dogs will engage the upper end of the setting sleeve. A downward thrust on the setting string will then force the setting sleeve downwardly to shear the pin 13 and compress the packing into the position shown in Fig. 5. When the setting sleeve has moved downwardly, it will be prevented from reverse movement upwardly by the engagement therewith of the dogs 19. The setting string may then be pulled upwardly and would ordinarily be withdrawn from the well. It is possible, however, to employ the setting string as an eduction tube if desired.

It is to be noted that my setting tool has a firm attachment to the upper end of the packer assembly and is sealed therewith through the packing 31. It is possible therefore to force fluid downwardly through the setting string and the liner while the device is lowered into the well. No leakage around the connection between the setting string and the liner is possible. After the liner has been set the connection between the setting string and the liner may be released without danger of the locking collar 27 binding against the setting nipple and an accurately operating release will be provided. The weight of the setting string at no time is supported upon the locking collar 27 the support being entirely upon the anti-friction bearings 33. The packer may then be expanded in the usual manner.

It is also to be noted that I have provided a particularly effective type of packer 11, which is adapted to seal between the liner and the casing. When the packing rings are compressed against the spacing member 15 they will tend to flatten out into a position more nearly radial to

the barrel and will thus form a tight seal as will be noted in Fig. 5. This type of packer has advantages over the usual canvas packer which does not always seal accurately.

What is claimed as new is:

1. In combination a packer barrel, a setting nipple extending upwardly therefrom, a packer on said barrel, a setting sleeve, a setting collar on said packer secured to said sleeve, a setting string, a mandrel, a collar connecting said string and said mandrel, a locking collar screwed upon the interior of said setting nipple, means on said mandrel engaging below said locking collar, a ring on said mandrel engaging above said setting nipple, said locking collar being released from said setting nipple through a righthand rotation of said mandrel, and means sealing between said mandrel and said nipple.
2. In combination a packer barrel, a setting nipple extending upwardly therefrom, a packer on said barrel, a setting sleeve, a setting collar on said packer secured to said sleeve, a setting string, a mandrel, a collar connecting said string and said mandrel, a locking collar screwed upon the interior of said setting nipple, means on said mandrel engaging below said locking collar, a ring on said mandrel engaging above said setting nipple, said locking collar being released from said setting nipple through a righthand rotation of said mandrel, and dogs on said mandrel adapted to engage above said setting sleeve when said mandrel is moved to raise said dogs to the required level.
3. In combination a packer barrel, a setting nipple extending upwardly therefrom, a packer on said barrel, a setting sleeve, a setting collar on said packer secured to said sleeve, a setting string, a mandrel, a collar connecting said string and said mandrel, a locking collar screwed upon the interior of said setting nipple, a sealing collar on said mandrel, a spacer adapted to be clamped downwardly by said locking collar to expand said sealing collar against said setting nipple, and

means on said mandrel engaging said locking collar to rotate the same and unscrew said locking collar, responsive to a righthand rotation of said mandrel.

4. A packer barrel, a packer thereon, a packer setting sleeve on said barrel above said packer, a setting tool including a mandrel engaging within said setting sleeve, a packing collar sealing between said mandrel and said barrel, means to attach said mandrel to said packer barrel acting also to compress said collar, outwardly movable dogs on said mandrel, said setting tool being releasable from said barrel by a righthand rotation of said mandrel, said dogs being adapted through movement of said mandrel to be engaged upon said setting sleeve to move said sleeve downwardly and expand said packer.

5. A packer barrel, a packer thereon, a setting sleeve on said packer, a setting nipple on said barrel, a setting mandrel, an anti-friction support for said mandrel on said nipple, a locking collar keyed to said mandrel and threaded to engage within said nipple, a sealing collar adapted to be expanded to seal against said nipple by said locking collar, dogs on said mandrel, said locking collar being releasable from said nipple by rotation of said mandrel, whereby said sealing collar is contracted and said dogs may be raised to a position above said setting sleeve.

6. A packer barrel, a packer thereon, a setting sleeve on said packer, a setting nipple on said barrel, a setting mandrel, an anti-friction support for said mandrel on said nipple, a locking collar keyed to said mandrel and threaded to engage within said nipple, a sealing collar adapted to be expanded to seal against said nipple by said locking collar, dogs on said mandrel, said locking collar being releasable from said nipple by rotation of said mandrel, in a righthand direction, the release of said locking collar acting to loosen said sealing collar and permit upward movement of said mandrel in said nipple.

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