Oct. 12, 1943. R. BASSINGER 2,331,532

WELL PLUG

Filed Aug. 24, 1940

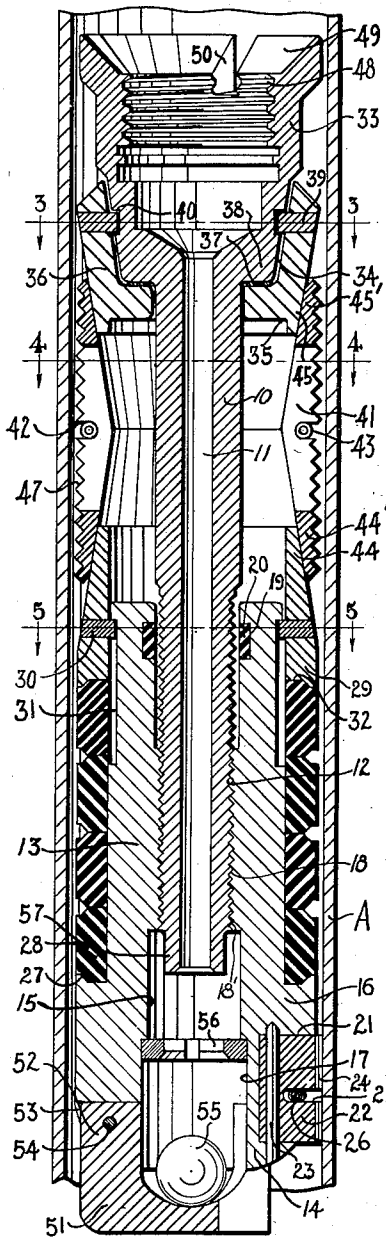


Fig 1

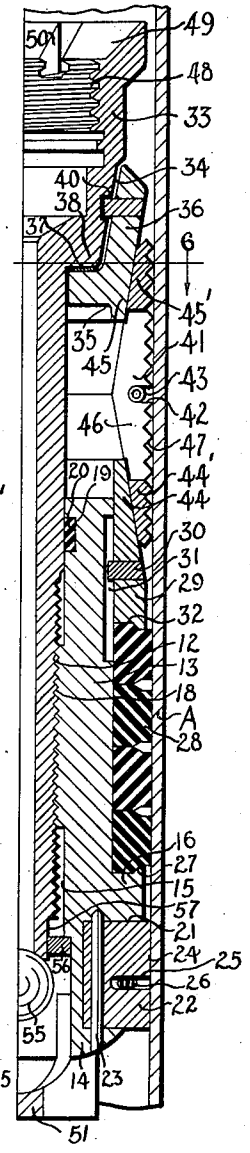


Fig 2

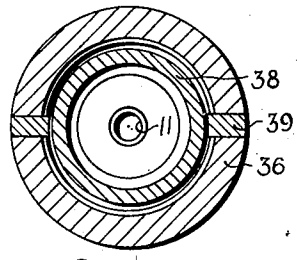


Fig 3

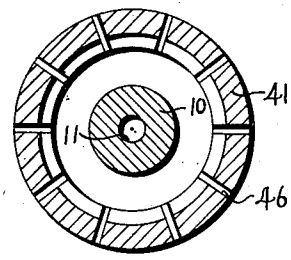


Fig 4

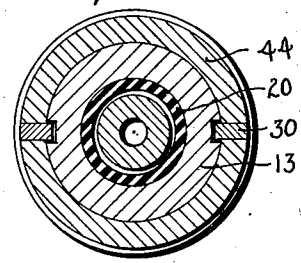


Fig 5

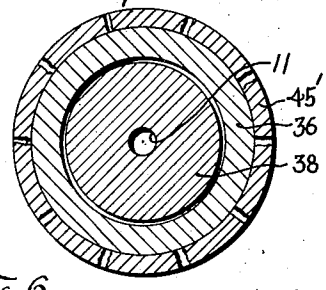


Fig 6

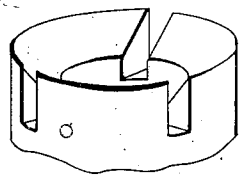


Fig 7

Inventor

ROSS BASSINGER

By Jack A. Ahley

Attorney

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WELL PLUG

Ross Bassinger, Houston, Tex.

Application August 24, 1940, Serial No. 353,990

3 Claims. (Cl. 166—12)

This invention relates to new and useful improvements in well plugs.

The invention has particularly to do with well plugs adapted to be set in a well casing and in some respects involves certain improvements upon my co-pending application, Serial No. 333,584, filed May 6, 1940.

One object of the invention is to provide an improved well packer having means for anchoring it in a well against longitudinal displacement by pressure exerted either upwardly or downwardly thereon.

Another object of the invention is to provide an improved well plug having casing gripping means arranged to be expanded by elements disposed to actuate said means from opposite longitudinal directions, whereby either upward and downward pressure or force, directed against the plug, will increase the set of the gripping means, thereby assuring against longitudinal displacement.

A further object of the invention is to provide an improved well plug which when anchored may be used as a support for a superimposed tool and which will hold said tool against rotation.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawing, in which an example of the invention is shown, and wherein:

Figure 1 is a longitudinal sectional view of a well plug constructed in accordance with the invention, illustrating the plug with its parts retracted so that it may be lowered into the well,

Figure 2 is a half view similar to Figure 1, showing the plug anchored in the well casing,

Figures 3, 4, 5, and 6 are transverse cross-sectional views taken on their respective lines on Figure 1, and

Figure 7 is an isometrical view of the box or socket at the upper end of the plug.

In the drawing, the numeral 10 designates an elongate tubular actuating member or mandrel which has an axial bore 11 extending therethrough. The lower portion of the mandrel is slightly reduced and provided with external screw threads 12. The mandrel telescopes the sleeve or shank 13 of an annular support or shoe 14. The sleeve 13 is provided with an axial bore 15 which terminates at its lower end at an annular shoulder 16 formed at the upper end of an enlarged axial bore 17 in the shoe. The bore 15 of the sleeve is formed intermediate its ends with internal screw threads 18 which receive the screw threads 12 of the mandrel, so that when the mandrel is rotated it will be moved longitudinally in the bore of the sleeve. It is pointed out that the lowermost thread 18' on said mandrel may be beveled or otherwise distorted after the mandrel has been inserted in the bore 15, and screwed therethrough. The distorting of said thread may be done so that said mandrel may not be accidentally backed out of said sleeve while said tool is being run into the well. However, any suitable means, such as the insertion of a pin in the lowermost end of the mandrel, may be employed to accomplish this result. In order to pack off the sleeve and the mandrel, an annular recess 19 is provided in the upper end of the bore for receiving an annular pressure-sealing packing ring 20 which has an internal diameter of such size as to permit the screw threads 12 to pass freely therethrough, but to snugly engage the smooth outer surface of the mandrel as shown in Figure 2.

The shoe 14 is provided with a plurality of elongate, radial, vertical recesses 21 in which suitable back-off dogs 22 are mounted. The dogs are secured by pins 23 which extend longitudinally of the recesses, said dogs being adapted to swing into engagement with the inside wall of the casing A upon clockwise rotation of the plug. Each of the dogs 22 carries vertical gripping teeth 24 upon its outer end, said teeth being so designed as to resist right-hand rotation of the sleeve. A horizontal groove 25 extends backwardly from each of the recesses, and a short coil spring 26 is positioned in each of the grooves. One end of each of the springs 26 is secured to the shoe 14 within one of the grooves, while the other end of each spring is secured to one of the dogs. Since the springs are under tension, they act to urge the dogs and the teeth constantly into engagement with the wall of the casing. It is pointed out that the teeth 24 are designed to allow vertical movement of the dogs, while resisting and substantially preventing lateral or rotative movement of the latter. Obviously, counter-clockwise or left-hand rotation of the sleeve will cause the dogs to swing inwardly out of engagement with the casing A.

The upper portion of the shoe is cut back to form an annular shoulder 27 for supporting a plurality of suitable elastic packing rings 28 which surround the sleeve 13. A frusto-conical slip-expanding collar 29 surrounds the upper end of the sleeve and is provided with inwardly-pro-

jecting, oppositely-disposed pins 30, engaging in upright grooves 31 formed in the outer surface of the sleeve at the upper end thereof. These pins and grooves permit the sleeve and collar to telescope, but cause them to rotate together. The bottom edge of the collar is undercut at 32 to engage the uppermost packing ring 28. When the collar 29 is moved downwardly, or the sleeve is moved upwardly, the packing rings 28 will be expanded so as to engage the casing A, as is shown in Figure 2.

A box or socket 33 is formed on the upper end of the mandrel, and is provided with an underlying annular shoulder 34 which overhangs an annular flange 35 provided in an upper slip expanding collar 36. A suitable metallic bearing ring 37 is interposed between the shoulder 34 and the flange 35, and sustains the thrust of the correlated members. The upper collar is rotatably confined on the shank 38 of the box 33 by means of diametrically-opposite pins 39 which engage in an annular groove or guideway 40 formed in the outer surface of the shank 38. It is preferable to incline the adjacent upright surfaces of the upper collar and the shank.

The lower slip expanding collar 29 is spaced a substantial distance from the upper slip expanding collar 36, and between these collars there is provided a cylindrical gripping or slip member 41 which has an annular groove 42 at its central portion, receiving a garter spring 43. It will be observed that the lower collar 29 has the major portion of its outer surface inclined inwardly and upwardly to form a lower frusto-conical, slip-expanding suface 44, while the upper collar 36 has its outer surface inclined downwardly and inwardly to form an upper frusto-conical slip-expanding surface 45. The slip member is provided with oppositely-inclined surfaces 44′ and 45′ which cooperate respectively with the surfaces 44 and 45.

The slip member is made with a plurality of spaced vertical slots 46 extending therethrough, intermediate its upper and lower ends, whereby comparatively short and thin webs are left at the upper and lower ends of the slots. When the collars are moved toward each other, and their slip-expanding surfaces thus caused to ride upwardly and downwardly on the faces 44′ and 45′, the webs will be fractured, whereby the slip member will be divided into a number of vertical slip sectors held together by the spring 43. Continued movement of the collars will expand the slips into engagement with the casing, as shown in Figure 2. The slip member is formed with circumferential saw teeth 47, and consequently will anchor against either upward or downward movement.

If only one expanding surface is provided, as shown in my co-pending application, hereinbefore referred to, fluid pressure exerted against the plug in one direction will expand the slips, but when fluid pressure is exerted against the plug in the opposite direction the slips will be released and there would be nothing to hold the plug against displacement. In the improved device, described herein, fluid pressure exerted upwardly against the plug would move the collar 29 upwardly and would cause the surface 44 to slide on the face 44′ and further expand the slips, whereby their teeth would bite more firmly or deeper into the casing. If pressure is exerted downwardly on the plug, the upper collar 36 would be depressed which would cause the surface 45 to slide down the face 45′ and further expand the slips, thus the plug will be held against displacement by forces from either direction.

In running the plug into the well, it is suitably attached to a proper tool and for this purpose, the box 33 is provided with internal screw threads 48 above which is an inclined lip 49. The lip and upper end of the box are provided with a plurality of radial slots 50 spaced to receive projections on any tool having the same which may be mounted on said box. Ordinarily, these slots may not be used, as for instance when the usual jars are connected in the box for the purpose of running and setting the plug. But should it be desired to support a liner or other device having lugs which are engaged in the slots 50, such liner or other device will be held against rotation as well as supported.

An anchoring spider 51, provided with upstanding blades 52 inserted in complementary slots 53 in the bottom of the shoe 14, is fastened to said shoe and held in position by transverse pins 54 which extend through the blades and adjacent portions of the shoe. This spider provides a cage for a valve ball 55. When the plug is lowered into the well, the fluid will move the ball upwardly against a seat ring 56. The lower end of the mandrel 10 is reduced at 57 so as to be moved through the ring 56 to displace the ball, as shown in Figure 2.

The setting of the plug is simply and easily carried out. The plug is run into the well, usually below jars (not shown) suspended from a string of tubing. The fluid present in the well will cause the valve ball 55 to move upwardly against the seat ring 56 which is slotted so as to permit a sufficient quantity of fluid to by-pass. When the desired point is reached in the well bore, the plug is rotated in a clockwise direction, whereby the springs 26 cause the dogs 22 to engage the wall of the well casing A, and whereby further rotation of the shoe 14 and the sleeve 13 is prevented. However, rotation of the mandrel is continued and through the coaction of the screw threads 12 and 18, the sleeve 13 and the mandrel 10 are moved relatively longitudinally so as to cause the collars 29 and 36 to telescope the slip member 41 and expand the same into gripping engagement with the casing, as hereinbefore explained.

When the slip member is fractured, and the slip sections bite into the casing wall, the plug is anchored. Continued rotation of the mandrel 10 will cause the packing rings 28 to expand and securely pack off the plug. As the mandrel moves downwardly, the reduced end 57 enters the ring 56 and engages the valve ball 55, as is shown in Figure 2. This shuts off further flow up the mandrel, and the well is thereby efficiently plugged. Any suitable type of wash-down device may be employed, and the plug may be drilled out if necessary.

Various changes, alterations, and modifications may be made in the size, shape, and arrangement of the herein described elements within the scope of the appended claims.

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

1. A well packing device including, an actuating member having a longitudinal bore therein, a support movably carried by the actuating member, the actuating member and the support being threadedly connected together for moving said support longitudinally of the member when said member is actuated, a packing mounted external-

ly on the support, casing-engaging dogs carried by said support, a cylindrical slip member having oppositely inclined interior surfaces, and separate slip-expanding means one of which is carried and actuated by the support and the other of which is carried and actuated by said actuating member engaging the inclined surfaces of the slip member and movable toward each other for expanding slip member when the actuating member is rotated and the support is held by the dogs.

2. A well packing device including, an actuating member having a longitudinal bore therein, a support movably carried by the actuating member, the actuating member and the support being threadedly connected together for moving said support longitudinally of the member when said member is actuated, a packing mounted externally on the support, casing-engaging dogs carried by said support, a lower collar having an upwardly directed external frusto-conical surface being slidably confined on the support, an upper collar having a downwardly directed external frusto-conical surface being rotatably confined on the actuating member, and a cylindrical slip member carried by the frusto-conical surfaces of the collars for expansion thereby upon relative movement of said collars toward each other as said actuating member is rotated relative to said support.

3. A well plug including, a longitudinal tubular mandrel, a box at the upper end of said mandrel, an upper collar rotatable on said upper end and having a conical expanding surface, a slip cylinder provided with external annular teeth having its upper end engaged around said upper collar, a sleeve having screw-threaded engagement with said mandrel, casing dogs carried by the sleeve, packing carried by the sleeve, and a lower collar slidably confined on the sleeve and having a conical expanding surface telescoping the lower end of the slip cylinder.

ROSS BASSINGER.