

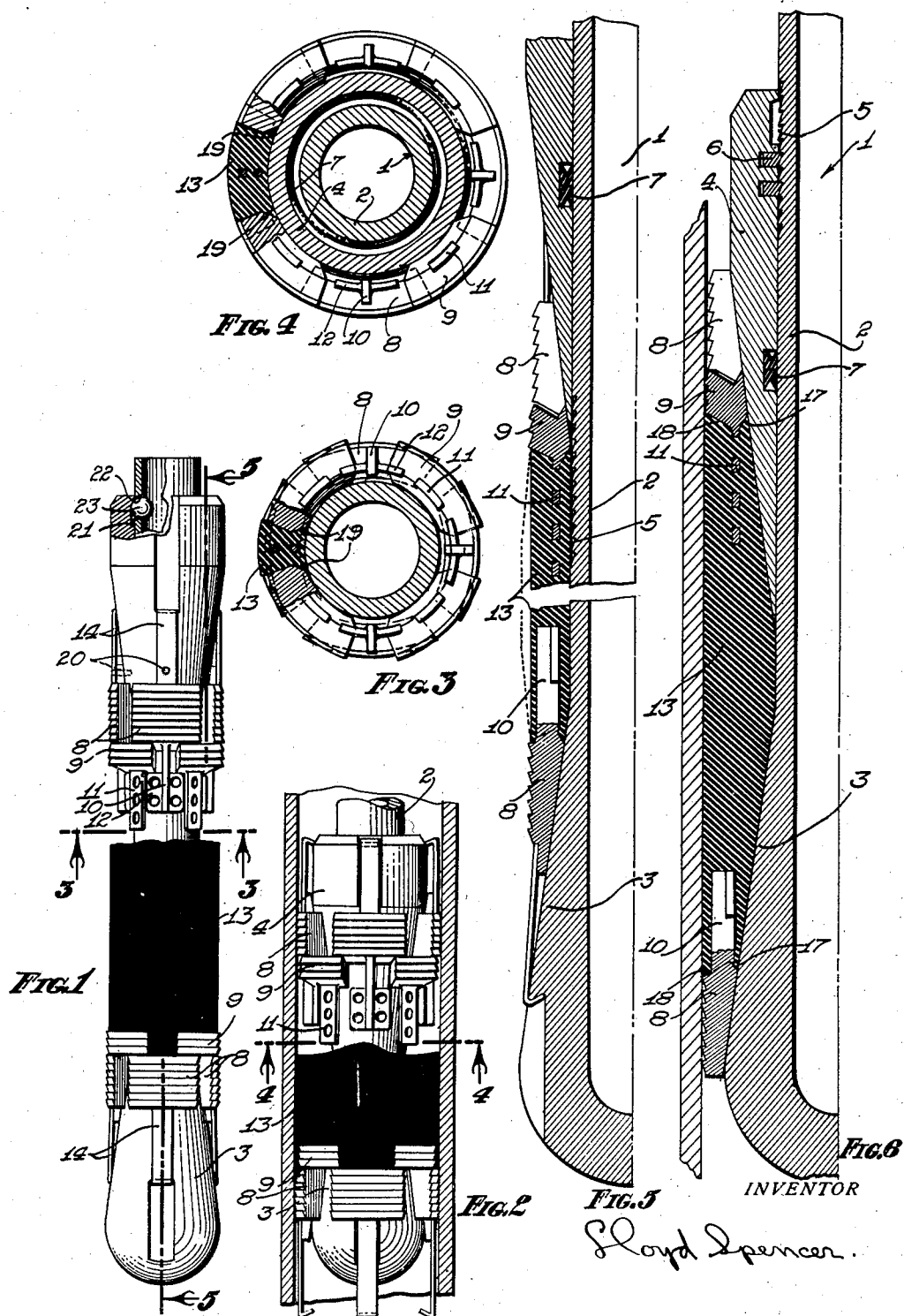
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BRIDGING PLUG

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BRIDGING PLUG

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7 Claims. (Cl. 166—13)

My invention relates to bridging plugs for oil wells, and among the objects of my invention are:

First, to provide a bridging plug having a resilient packing sleeve which is held under tension while the bridging plug is lowered into position, thereby reducing the diameter of the packing sleeve to increase the circulation area between the bridging plug and the surrounding casing and facilitate movement of the bridging plug in the well;

Second, to provide a bridging plug wherein locking slips are cast in the ends of the packing sleeve so that the packing sleeve serves to hold and guide the slips in position, and the slips provide means whereby the packing sleeve may be placed under tension;

Third, to provide a bridging plug of this character which incorporates a novel slip and packing sleeve arrangement in which the slips serve as an abutment to prevent axial flow of the packing sleeve between the well casing and bridging plug under conditions of extreme heat and pressure; and

Fourth, to provide a bridging plug of this character which is particularly adapted for use in conjunction with a setting tool described in co-pending application, Serial No. 308,608, filed December 11, 1939, thereby providing a bridging plug which may be suspended from a cable.

With the above and other objects in view, as may appear hereinafter, reference is directed to the accompanying drawing, in which:

Figure 1 is an elevational view of my bridging plug with the parts in the position assumed when the plug is being lowered into a well bore, a portion of the packing sleeve being broken away to facilitate the illustration;

Figure 2 is a similar elevational view of my bridging plug with the parts shown in the position assumed when the plug is set within a casing, said casing being shown in section and fragmentarily;

Figure 3 is an enlarged transverse sectional view through 3—3 of Figure 1 with the packing sleeve partially removed to show the position of the slips;

Figure 4 is a similar transverse sectional view taken through 4—4 of Figure 2, likewise with the packing sleeve partially removed;

Figure 5 is a longitudinal sectional view taken through 5—5 of Figure 1, showing one-half of the bridging plug with the parts in the position assumed when the plug is being lowered into the well; and

Figure 6 is a similar longitudinal sectional

view showing the parts in the positions assumed when the bridging plug is seated.

My bridging plug includes a body 1 comprising a tubular portion 2 of uniform diameter, the lower end of which is connected to or joined integrally with a conical portion 3. The conical portion is closed at its lower or larger end. A sliding cone 4 is mounted on the tubular portion 2 and the sloping faces of the two cones 3 and 4 confront each other. The tubular portion 2 is provided with wickers 5 which, when the sliding cone is moved downwardly, are engaged by locking rings 6 set in annular grooves provided in the sliding cone, so as to prevent return movement of the sliding cone. In addition, a sealing ring 7 may be provided between the sliding cone and tubular portion 2.

The two cones are adapted to coact with main slips 8 and bridging slips 9. In the drawing four main slips and four bridging slips are shown in coaction with each cone. The slips 8 and 9 are in the form of cylindrical segments, the main slips 8 being somewhat larger than the bridging slips and shaped to fit higher on their respective cones.

Anchor tongues 10 extend from the main slips between the bridging slips, and anchor tongues 11 extend from the bridging slips. The anchor tongues are adapted to be molded into the ends of a packing sleeve 13 which initially fits around the tubular portion 2, covers the anchor tongues 10 and 11 and fills the spaces between the bridging slips 9. The anchor tongues 10 are provided with side lugs 12 which are adapted, when the slips are in their initial or retracted position, to engage the axially inner corners of the bridging slips 9, so that the main slips cannot move upwardly on the cone without the bridging slips following.

The main slips have extending axially therefrom strap hooks 14 which ride in and hook into the inner ends of slots 15 and 16 provided in the moving cone 4 and the conical portion 3, respectively. The strap hooks 14 hold the slips in position so that when the moving cone is moved upwardly away from the conical portion 3 the sleeve 13 may be placed under tension. The packing sleeve may have an initial diameter such as shown by dotted lines in Figure 5, and may be stretched so that its diameter is reduced to the solid line position in Figure 5 and the position shown in Figure 1.

In order to facilitate fluid-tight seal between the packing element and the outside casing, as well as the packing sleeve and the body of the

bridging plug, the edges of the slips which confront the packing sleeve are beveled at their radially inner and outer corners so that the conforming packing sleeve forms pressure lips 17 and 18. Similarly, the ends of the bridging slips 9 are undercut so that the tongues of the packing sleeve 13 which extend between the anchor slips are provided with pressure lips 19, as shown best in Figures 3 and 4.

One set of the main slips 8 are provided with shear pins 20 for the purpose of holding the corresponding set of slips during the initial setting movement of the bridging plug, as will be described hereinafter.

It is intended that my bridging plug be used with the setting tool described in the hereinbefore-mentioned patent application. For this purpose the upper end of the sliding cone 4 is provided with a channel 21 and holes 22 are provided in the upper end of the tubular portion 2, which holes align with the channel when the packing sleeve has been stretched a predetermined amount. Key balls 23 fit in the holes 22 and bear against the edge of the channel 21. The key balls coact and form part of the setting tool hereinbefore mentioned.

Operation of my bridging plug is as follows: The parts of the bridging plug are initially set in the positions as shown in Figures 1 and 5, that is, the packing sleeve 13 is placed under tension so that its diameter is reduced to the nominal diameter of the bridging plug when the parts are held by the setting tool with which the bridging plug is lowered.

When the bridging plug has been lowered to position the setting tool is actuated, which allows the key balls 23 to move inwardly, freeing the sliding cone 4. A spring, not shown but constituting part of the setting tool, forces the sliding cone 4 downwardly while other parts of the setting tool pull upwardly on the body 1, so that the two cones are moved toward each other. This movement of the cones causes the slips to ride up their conical faces and engage the surrounding casing. By reason of the shear pin 20 one set of slips moves into locking position before the pins shear; this permits the other set of slips to compress the packing element until in a sealing position, such as is shown in Figure 6, before the pins shear. The second set of slips then move up their cone by reason of the force exerted by the compressed packing sleeve, and at the same time the cone is wedged further into the sleeve.

By reason of the fact that the packing sleeve is initially under tension, a minimum of force is required to move it into a packing position, initial movement being aided by the resiliency of the material constituting the packing sleeve. The packing sleeve is formed of rubber, synthetic rubber or analogous material that may or may not contain reinforcing. Inasmuch as a bridging plug is designed to be placed within wells and left there for long periods of time, if not permanently, it is desirable that the rubber constituting the packing sleeve be restrained from flowing by the parts of the bridging plug. This is prevented by reason of the bridging slips 9 which, together

with the main slips, form a complete ring against which the packing sleeve abuts.

By reason of the fact that the packing sleeve is under tension when the bridging plug is being lowered and partly fills the space between the bridging plug and the casing when in its normal position, the clearance when running in may be maximum so that adequate circulation may be had around the bridging plug to permit rapid movement of the plug through the well liquid therein.

Various changes and alternate arrangements may be made within the scope of the appended claims, in which it is my intention to claim all novelty inherent in the invention as broadly as the prior art permits.

I claim:

1. A bridging plug for wells comprising: a yieldable tubular packing sleeve adapted, when stretched, to reduce its diameter; means for holding said packing sleeve in a stretched condition while lowering said sleeve into a well bore; means for releasing said sleeve; and means for deforming said sleeve by axial compression and radial expansion beyond its normal condition.

2. A bridging plug for wells comprising: a mandrel; coacting wedging cones thereon adapted to be moved toward each other; a deformable packing sleeve between said cones; and sets of wedging slips molded in the ends of said sleeve and adapted to ride upon said cones, said wedging slips arcuately overlapping each other to form an annular abutment for each end of said sleeve.

3. A bridging plug for wells comprising: a pair of confronting wedging cones; coacting sets of slips for said cones adapted to engage a surrounding casing; a deformable packing sleeve mounted between said sets of slips and attached thereto; and means for exerting a tensional load on said packing sleeve tending to reduce the diameter thereof.

4. A bridging plug comprising: a deformable packing sleeve; wedging slips molded in the ends of said sleeve and circumferentially overlapping each other to form a continuous abutment for the ends of said sleeve; cone elements adapted to spread said slips into engagement with a surrounding casing; means initially connecting said slips to said cone elements; and means for holding said cone elements in an axially separated position wherein said sleeve is under tension.

5. A bridging plug, as set forth in claim 4, wherein said cones and slips are relatively movable to place said packing sleeve under axial compression and radial expansion against a surrounding casing, and said packing sleeve has intermediate normal dimensions.

6. A bridging plug as recited in claim 2 wherein the ends of said slips abutting said sleeve are shaped to mold radially inner and radially outer pressure lips on said sleeve.

7. A bridging plug as recited in claim 4 wherein the ends of said slips abutting said sleeve are shaped to mold radially inner and radially outer pressure lips on said sleeve.

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