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BRIDGING PLUG SLIP MEANS

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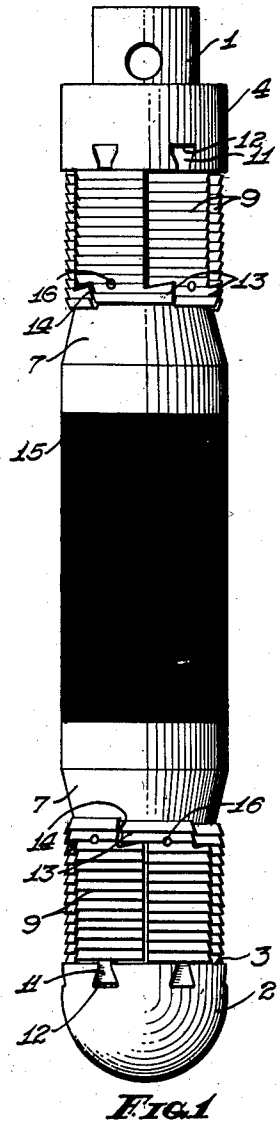


FIG. 1

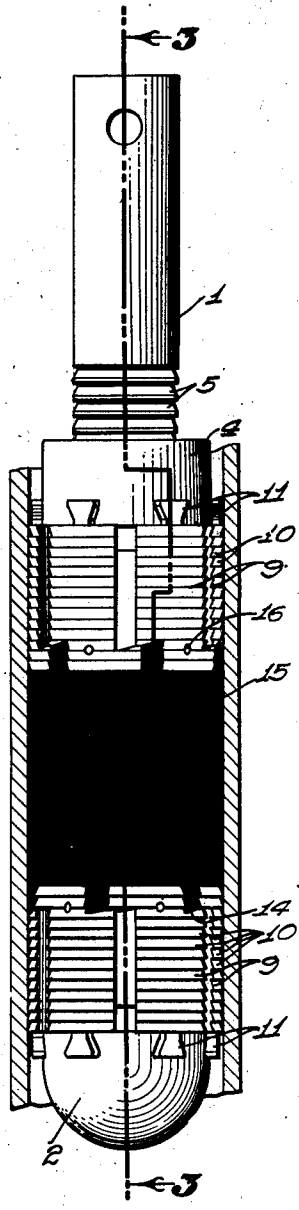


FIG. 2

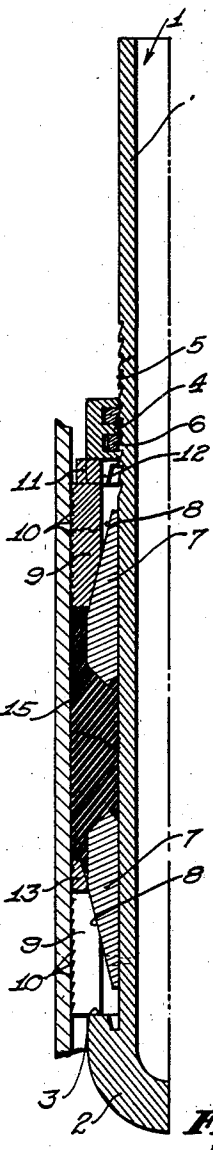


FIG. 3

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BRIDGING PLUG SLIP MEANS

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Application January 22, 1940, Serial No. 315,045

5 Claims. (Cl. 166—13)

My invention relates to bridging plugs, more particularly to a slip construction for bridging plugs. Among the objects of my invention are:

First, to provide a bridging plug having slips adapted to occupy a seated position at opposite ends of a packing sleeve, the slips being so arranged as to form a continuous abutment around the periphery of the packing sleeve to prevent axial flow of the material constituting the packing sleeve;

Second, to provide a bridging plug which, by reason of the support afforded the packing sleeve when the plug is set, may be so constructed as to have a relatively small diameter compared to the casing in which it fits so as to provide a maximum circulation area between the bridging plug and the casing, thus facilitating movement of the bridging plug through the casing when the casing is filled with liquid;

Third, to provide a bridging plug which, by reason of the support afforded the packing sleeve, may employ a packing sleeve formed of relatively soft rubber or analogous material whereby the force required to distort the packing sleeve into its sealing position is minimized; and

Fourth, to provide a bridging plug which is particularly designed for suspension from a cable and set by a setting tool such as shown in the copending application, Serial No. 308,608, filed December 11, 1939.

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 positions assumed when the bridging plug is being lowered into a well;

Figure 2 is a similar elevational view showing the parts of the bridging plug in the positions assumed when the bridging plug is seated within a well casing, the well casing being shown in section and fragmentarily; and

Figure 3 is a longitudinal sectional view of the bridging plug in its seated position, taken substantially along the line 3—3 of Figure 2, only one-half of the section being shown to avoid duplication.

My bridging plug comprises a tubular body member 1 of substantially uniform diameter, the lower end of which is closed by a nose piece 2 which is somewhat larger in diameter than the body 1 and forming therewith a shoulder 3.

A collar 4 is slidably fitted around the other or upper end of the body member and is provided with internal annular channels which receive slip locking rings 5. These ride upon the body 1 and are adapted to engage wickers 6 formed in the body member so that the collar may move downwardly upon the body member, but will lock against return movement.

Between the shoulder 3 and collar 4 there is slidably mounted upon the body member 1 a pair of cone sleeves 7. These have conical slip-engaging faces 8 converging toward the shoulder 3 or collar 4, as the case may be. Each conical sleeve 7 is adapted to coact with a plurality of slips 9. Each slip 9 is in the form of a cylindrical segment, the outer surface of which has a radius corresponding approximately to the diameter of the casing in which it is desired to set the bridging plug. This surface is provided with serrations 10. The inner surface of each slip is frusto-conical, at least in part, to conform to the slip-engaging faces 8 of the corresponding conical sleeve.

Each slip is provided with a dovetail lug 11 and the collar 4, as well as the nose 2, is provided with dovetail slots 12 formed radially therein and which receive the lugs 11 so that the slips are free to move radially outward but not axially with respect to the nose 2 or collar 4, as the case may be.

The other or extended end of each slip 9 is provided with a lateral, circumferentially extending lip 13 which is adapted to fit into a notch 14 formed in the confronting edge of the adjacent lip.

Each of these slips is initially held on its cone by shear pins 15. The slips are so arranged initially that the shear pins are not all placed on a shearing strain at one time, but in regard to certain of the slips, clearance is had between the shoulder 3 or collar 4, as the case may be.

Between the conical sleeves 7 there is fitted a packing sleeve 16 formed of synthetic rubber or analogous deformable material. The confronting ends of the conical sleeves are shaped so that when the sleeves are moved toward each other the packing sleeve may be deformed outwardly into contact with the surrounding casing, as shown best in Figures 2 and 3.

Operation of my bridging plug is as follows: The bridging plug is initially in the position shown in Figure 1, in which position sufficient clearance is provided between the bridging plug and the surrounding casing to permit ready descent to the desired location. Means (not shown and which constitute part of a setting tool shown and described in the hereinbefore mentioned application) are so arranged that when the setting tool

is operated the collar 4 is forced downwardly and the body 1 is drawn upwardly. This causes the conical sleeves 7 to move toward each other, distorting and expanding the packing sleeve into contact with the surrounding casing. Continued movement of the collar 4 causes the slips 9 to shear their pins 15 and move radially outward on their respective cones into wedging contact with the surrounding casing. When the slips have reached their locking position, such as shown in Figures 2 and 3, their extended or confronting ends form a continuous abutment for the packing sleeve therebetween. The lips 13 remain in slightly overlapping relation with the notches 14 so that the packing sleeve cannot flow axially between the slips and for the limited distance determined by the depth of the notches 14. The slight slope given the inner edges of the lips 13 and the notches permits the slight axial offset spacing of the slips to avoid simultaneous shearing of the pins 15 and yet insure close contact when the slips are set to prevent flow of the packing sleeve.

It should be borne in mind that bridging plugs are often set in wells wherein the temperature is relatively high and the fluids contained therein have a tendency to swell and soften rubber and even many synthetic rubber compositions. Bridging plugs are intended to be set in the well and left there for long periods of time, often permanently, and inasmuch as rubber and many of the synthetic rubber compositions that are suitable for this purpose behave as liquids under the temperature and pressures encountered, the packing sleeve tends to flow until all available space is filled, and unless restrained will continue to flow axially until leakage may occur around the packing sleeve. With the particular arrangement of the slips herein shown, a continuous abutment is afforded which limits the axial flow of the packing sleeve.

It is not necessary that the packing sleeve when first set completely fill the spaces as shown in Figures 2 and 3. The packing sleeve swells and softens under the conditions of heat and pressure involved, and the packing sleeve will ultimately completely fill the space without disturbing its function as a sealing medium between the casing and the bridging plug body.

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 comprising: a packing sleeve; cone and slip means on opposite sides of said packing sleeve and engageable therewith to deform said packing sleeve into sealing contact with a surrounding casing; and means incorporated with each of said slips and forming expansible arcuately overlapping abutments for limiting axial flow of said packing sleeve.

2. A bridging plug comprising: a packing sleeve; cone and slip means on opposite sides of said packing sleeve and engageable therewith to deform said packing sleeve into sealing contact with a surrounding casing, said slips having circumferentially overlapping means at their ends confronting said packing sleeve to form a circular abutment for restricting axial flow of said packing sleeve.

3. A bridging plug comprising: a packing sleeve; an expander at one end of said sleeve; slip means coacting with said expander to secure the same relatively to a surrounding well casing, the extremities of said slips confronting an end of said packing sleeve and having circumferentially overlapping portions at their extremities to form a circular abutment for said packing sleeve.

4. A bridging plug comprising: a packing sleeve; an expander at one end of said sleeve; slip means coacting with said expander to secure the same relatively to a surrounding well casing, the extremities of said slips confronting an end of said packing sleeve and having circumferentially overlapping portions at their extremities to form a circular abutment for said packing sleeve, said slips having the form of segmental sections; and means for holding said slips in equally spaced relation around said expander.

5. A bridging plug comprising: a mandrel; a packing sleeve mounted thereon; expander sleeves at each end of said packing sleeve; slips adapted to spread on said expander sleeve upon movement thereon toward said packing sleeve, whereby when said slips engage a surrounding casing they confront the ends of said packing sleeve and circumferentially-extending bridging means incorporated with each of said slips to present a series of abutments between the slips for limiting axial flow of the material comprising said packing sleeve.

CHARLES H. BARNES.