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BRIDGING PLUG FOR OIL WELLS

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The chief object of this invention is to provide a plug which may be easily lowered in a well casing and quickly set at any desired depth therein to form a barrier for the usual cementing-off operation in order to prevent water from the formation entering the casing above the oil zone.

Another object of this invention is to provide a bridge plug constructed in such a manner that after the plug has been located and set at the desired depth in the well casing any downward pressure thereon will tend to tighten or hold it in place.

A further object of this invention is to provide a plug constructed in such manner that it may be inserted and set in a conduit by a setting tool, and released therefrom by pulling the setting tool, the action of which will disconnect the setting tool from the plug.

Other objects and advantages will appear from the following disclosure in which:

Fig. 1 is a sectional view of the bridge plug as it appears while being lowered in the casing.

Fig. 2 is a view similar to Fig. 1 showing the bridge plug after it has been set.

Figs. 3 and 4 are sectional views taken on lines 3—3 and 4—4 of Fig. 2.

Fig. 5 is a sectional view taken on line 5—5 of Fig. 1.

Fig. 6 is a sectional view taken on line 6—6 of Fig. 2.

Referring by numerals to the drawings, the body of the bridge plug is designated at 10 and is of cylindrical form and constructed of wood or other suitable material in order that it may be drilled through after the cement has set.

A bore 12 is formed in the center of the plug through which passes a tubular mandrel 14, its lower end extending through a counterbore 15, and has secured to the portion extending below the plug a pair of bow springs 18, their ends being affixed to collars 19 rigidly mounted in position on the mandrel, their functions being described hereinafter.

Oppositely disposed slips 20 having teeth 21 are positioned about midway of the body and are slidably on outwardly inclined dove-tail guides 24 meshing with corresponding grooves in the slips, the projections being reinforced by backing of thin sheet metal 25.

The slips 20 serve to hold the plug from downward movement after the plug has been set, and are indirectly connected to the mandrel 14 by pins 26, the outer ends extending through holes 27 in the slips, their inner ends being screw-threaded or otherwise secured to an annular flange 28 formed on the mandrel. Centrally disposed slots 30 are formed in the reduced tapered portion 31 of the body to accommodate movement of the pins 26. In order to lower the plug into the well it is necessary to contract or draw the slips 20 inward so their teeth 21 will not engage the wall of the casing, this being accomplished by forcing the mandrel downward by means of a setting tool 32, the lower end of which rests on the upper end of the mandrel as shown in Fig. 1.

During a downward movement of the mandrel an expansion coil spring 34, mounted on the mandrel 14 between the flange 28 and a shoulder 36 formed at the juncture of the bores 12 and 15, is compressed. In order to maintain the slips 20 in a contracted position a plurality of links 38, preferably formed of wire, are connected to the setting tool 32 and the plug 10 through ears 40 on the setting tool and ears 42 on a head or block 44 secured to the upper end of the body, it being understood that the links are connected prior to inserting the plug in the casing.

Packing 46 preferably formed from a pliable material, such as leather, and in the form of a disk having a circular flange 47 adapted to engage the inner wall of the casing is positioned between the body and the head 44, the head and packing 46 having openings 48 and 49 respectively through which the setting tool may pass, the head being secured to the body by lag screws 50.

A plurality of slips 52 having teeth 53 adapted to engage the casing on an upward movement of the plug are slidably mounted in recesses 54 provided with thin metal lin-
ing 55, the slips having bevelled edges 56 in order to prevent them from being disengaged from the body of the plug. The flap valve 60 is hinged at 61 to a plate 62 having an opening 63 therein and secured to the head by the lag screws 50, the valve closing the opening in the head 44 when the plug is set.

In operation the slips 20 are contracted and retained in such position by the links 38, the setting tool and other parts then assuming the respective positions shown in Fig. 1. The setting tool is then connected to suitable lowering tools 64 by a coupling 65 and lowered in the casing —C— to the required depth, fluid in the casing passing through the openings in the mandrel, setting tool, head, and lowering tools.

In order to set the plug the lowering tools are pulled upward, which operation will cause the slips 52 to engage the casing and thereby prevent the plug from raising. Continued pull on the setting tool will then break or disconnect the links connecting the setting tool to the plug, whereby releasing the setting tool. Instantaneously upon release of the setting tool the body of the plug will be forced downwardly due to the expansion of the coil spring 34, and during such downward movement of the body the mandrel is held in a fixed position by the bow springs 18, thereby causing the slips to expand against and engage the casing. After the setting tool has been removed from the plug, the valve 60 will automatically close the opening in the head 44 as shown in Fig. 2. Cement may then be poured on top of the plug, the valve 60 and packing 46 preventing any fluid or cement passing through or around the plug.

From the above construction it will be seen that after the setting tool has been released any downward pressure on the plug will tend to tighten it.

We claim:

1. A bridging plug comprising a body member carrying an assembly of slips adapted to be engaged to a wall of a well casing into which the bridging plug has been inserted on a downward movement of the same, a second assembly of slips adapted to engage the wall of the casing on an upward movement of the body member, a compression spring engaging the mandrel and normally holding the first mentioned assembly of slips out of engagement with the wall of the casing while the plug is being lowered into position, means for expanding the first assembly of slips into engagement with the wall of the casing to plug the same, a packing member at the top of the body member for closing the casing above said body member, and means to lower said bridge plug into the well.

2. A bridging plug for oil wells compris-