

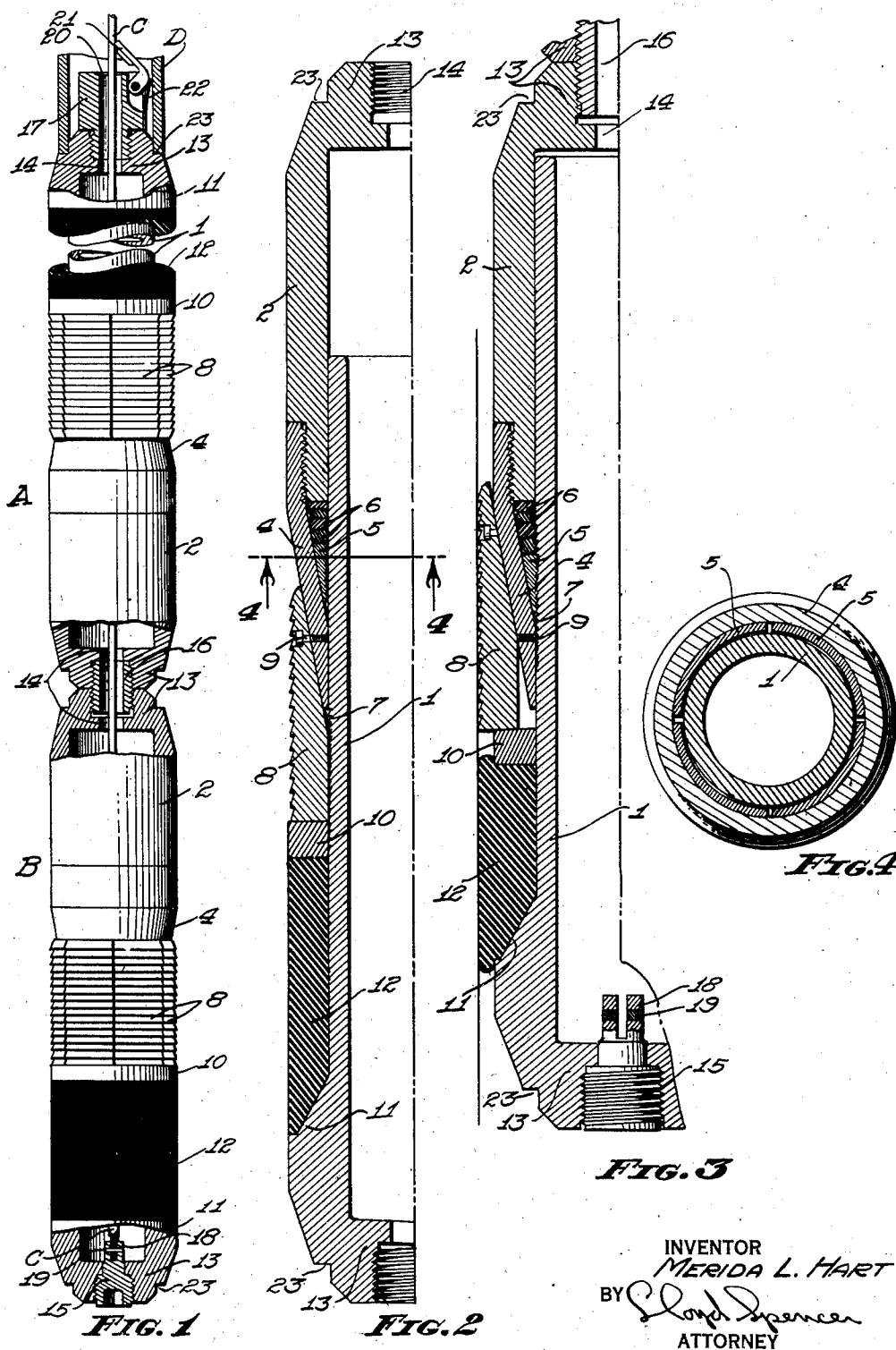
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BRIDGING PLUG DEVICE

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BRIDGING PLUG DEVICE

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4 Claims. (Cl. 166—13)

My invention relates to bridging plug devices and among the objects of my invention are:

First, to provide a bridging plug unit which may be used either end uppermost and which may be used singly or in pairs so that a fluid seal in a well casing may be effected in either direction only or in both directions, as desired;

Second, to provide a bridging plug which may be constructed entirely of readily drillable material such as cast iron or aluminum with rubber or analogous material;

Third, to provide a bridging plug which is provided with a novel clutch adapted to hold the parts in their locked position, the clutch being urged into position by rubber compression elements;

Fourth, to provide a bridging plug which is particularly adapted to be set by either of my cable-suspended setting tools disclosed in applications, Serial Nos. 373,902 and 373,904, filed January 10, 1941, now Patents 2,279,676 of April 14, 1942, and 2,308,004 of January 12, 1943, respectively; and

Fifth, to provide a bridging plug which is particularly simple and economical of manufacture, adapted to be made of inexpensive material and which may be readily drilled up should it be desired to remove the plug.

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

Figure 1 is a partial elevational, partial sectional view of my bridging plug in which two bridging plug units are connected end to end for the purpose of locking against movement in either direction, the parts of the plug being shown in the positions assumed when running into the well;

Figure 2 is a longitudinal half sectional view of one of the bridging plug units with the parts in their initial position;

Figure 3 is a similar longitudinal half sectional view showing the parts of my bridging plug unit as they appear when set within a well; and

Figure 4 is a transverse sectional view through 4—4 of Figure 2.

My bridging plug, as illustrated in Figure 1, comprises two identical units to form a connecting member, A and B, which may be used separately or in combination. Each bridging plug unit includes a tubular mandrel 1, over one end of which is adapted to telescope a sleeve 2. The overlapping end of the sleeve 2 is externally threaded to receive a cone 4 which converges from the periphery of the sleeve to the surface of the mandrel 1. The cone 4 is hollow to form a wedge-shaped

space in which are positioned a plurality of segmental locking wedges 5 having teeth in their inner peripheries. Between the base ends of the wedges 5 and the end of the sleeve 2 are positioned one or more compression rings 6 which are formed of rubber and which urge the locking wedges 5 between the cone and mandrel. The wedges 5 are adapted to coact with annular teeth 7 provided in the mandrel 1 so that the sleeve 2 may be telescoped over the mandrel, but is prevented from being removed therefrom.

The outer periphery of the cone 4 receives a plurality of slips 8, which are likewise in the form of segmental wedges and are provided with teeth in their outer peripheries. The slips 8 coact in a conventional manner with a surrounding casing, that is, they wedge between a surrounding casing and the cone to lock the cone in position. The slips 8 are initially held on the cone 4 by shear screws 9. The base ends of the slips 8 abut a ring 10 which is slidable on the mandrel 1.

At its end opposite the sleeve 2 the mandrel 1 is enlarged to form a beveled abutment 11 for a packing sleeve 12 which is positioned between the abutment 11 and the ring 10. Movement of the ring 10 toward the abutment 11 axially compresses and radially expands the packing sleeve 12 into contact with a surrounding casing, as shown in Figure 3. The packing element is, of course, formed of rubber or any of the synthetic resilient materials having rubber-like qualities, preferably materials which are inherently oil-resistant.

The mandrel 1 is provided with an internal end flange 13 and the sleeve 2 is likewise provided with an identical internal flange 13, the flanges being integral with the mandrel and sleeve, respectively. Each internal flange is provided with a bore 14 which is threaded at its outer portion and reduced slightly in diameter at its inner portion to form a shoulder.

The internal flanges 13 are adapted to receive interchangeably an anchor plug 15, nipple 16 or valve body 17. The anchor plug 15 is provided with a bifurcated inner end 18 which is adapted to receive a rod C forming a part of the setting tool, described more particularly in the above-mentioned copending application. The anchor plug is connected to the setting rod by a shear pin 19.

The nipple 16 is merely an externally threaded sleeve which is adapted to screw into the bores 14 of two bridging plug units so that they may be joined end to end.

The valve body 17 is provided with a screw-threaded portion adapted to fit the bore 14 and

is provided at its outer end with a valve seat 20. At one side the valve body pivotally supports a flap valve 21 which is urged into a seating position by a leaf spring 22.

My bridging plug is operated as follows: If it is desired to seal against pressure from either direction within a well bore, the two bridging plug units A and B are used. These are joined together by the nipple 16. They may be joined as shown, with the sleeves 2 together, or they may be joined with the mandrels adjacent. The anchor plug 15 is threaded into the lower end of the lowermost bridging plug unit, the setting rod however being first attached. The setting rod extends upwardly through the nipple 16 and through the valve body 17, and initially holds the flap valve 21 open, as shown in Figure 1. The bridging plug units are set by pulling upwardly on the setting rod while holding or forcing downwardly on the upper end of the uppermost plug unit. For this purpose each end of each bridging plug unit may be provided with shoulders 23 which coact with the setting tube, designated D and shown fragmentarily in Figure 1.

If it is desired to seal against pressure in one direction only, only one of the bridging plug units need be employed. If it is desired to seal against pressure from below the unit is positioned so that the packing sleeve 12 and the mandrel are lowermost, that is, in the position of unit B in Figure 1. The valve body 17 may or may not be substituted for the nipple 16 because the packing sleeve insures a seal between the mandrel and the casing.

If it is desired to seal against pressure from above and the bridging plug unit is positioned with the sleeve and mandrel directed upwardly, corresponding to the position of unit A in Figure 1, the anchor 15 is then in such case substituted for the nipple 16 and it is preferred to use the valve body 17 so that pressure from above will not be applied against the sleeve 2. However, the compression rings 6 which operate against the locking wedges 5 tend to seal against any flow of fluid around the packing sleeve 12.

Furthermore, should it be desired to withhold against extreme pressures, it is possible to use the bridging plug unit in tandem, that is, with one or the other of the units shown in Figure 1 reversed so that they both function to seal against pressure in the same direction.

All metal parts of the bridging plug units are preferably constructed of friable or drillable material such as cast iron or aluminum alloys so that, should it be desired to remove the bridging plug later, it may be drilled up.

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 so constructed and arranged as to be operative with either end uppermost, comprising a tubular sleeve and a tubular mandrel in telescoping relationship to said sleeve, a frusto-conical member secured to and surrounding said sleeve, slips surrounding said mandrel and arranged to be expanded into contact with a surrounding casing by said frusto-conical member upon relative telescoping movement of said sleeve and mandrel, a packing sleeve surrounding said mandrel longitudinally spaced from said slips and adapted to be axially compressed and

radially expanded upon relative telescoping of said tubular sleeve and mandrel, one end of said bridging plug being provided with a threaded opening, and the opposite end of said bridging plug being provided with a threaded opening, said threaded openings in the opposite ends of said bridging plugs being of the same size and configuration whereby said bridging plug may have its respective ends reversed, and an anchor plug arranged to be received in the threaded opening in the lower end of said bridging plug.

2. A bridging plug so constructed and arranged as to be operative with either end uppermost, comprising a tubular sleeve and a tubular mandrel in telescoping relationship to said sleeve, a frusto-conical member secured to and surrounding said sleeve, slips surrounding said mandrel and arranged to be expanded into contact with a surrounding casing by said frusto-conical member upon relative telescoping movement of said sleeve and mandrel, a packing sleeve surrounding said mandrel, longitudinally spaced from said slips and adapted to be axially compressed and radially expanded upon relative telescoping of said tubular sleeve and mandrel, one end of said bridging plug being provided with an opening, and the opposite end of said bridging plug being provided with an opening, said openings in the opposite ends of said bridging plug being of the same size and configuration whereby said bridging plug may have its respective ends reversed, and an anchor plug arranged to be secured in the opening in the lower end of said bridging plug.

3. A pair of bridging plugs each of which comprises a tubular sleeve and a tubular mandrel in telescoping relationship to said sleeve, a frusto-conical member secured to and surrounding said sleeve, slips surrounding said mandrel arranged to be expanded into contact with a surrounding casing by said frusto-conical member upon relative telescoping movement of said sleeve and mandrel, a packing sleeve surrounding said mandrel and adapted to be axially compressed and radially expanded upon relative telescoping of said sleeve and mandrel, a threaded connecting member securing said pair of bridging plugs in end to end relationship, the outer end of said sleeve and the outer end of said mandrel of each of said bridging plugs having a threaded opening, all of said threaded openings being of the same size and configuration whereby either end of one of said bridging plugs may be connected to either end of the other of said bridging plugs.

4. A pair of bridging plugs each of which comprises a tubular sleeve and a tubular mandrel in telescoping relationship to said sleeve, a frusto-conical member secured to and surrounding said sleeve, slips surrounding said mandrel arranged to be expanded into contact with a surrounding casing by said frusto-conical member upon relative telescoping movement of said sleeve and mandrel, a packing sleeve surrounding said mandrel and adapted to be axially compressed and radially expanded upon relative telescoping of said sleeve and mandrel, the outer ends of both of said bridging plugs being all of the same size and configuration and so constructed that either end of each bridging plug may cooperate with a connecting member for connecting said bridging plugs in end to end relationship, and a connecting member connecting an end of one of said bridging plugs to an end of the other of said bridging plugs.

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