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E. J. ROACH ET AL

2,315,134

WELL CONTROL HEAD

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Fig. 1

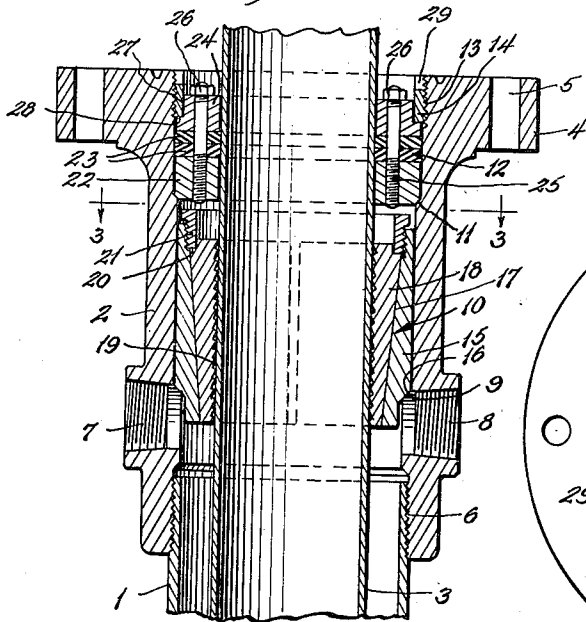


Fig. 2

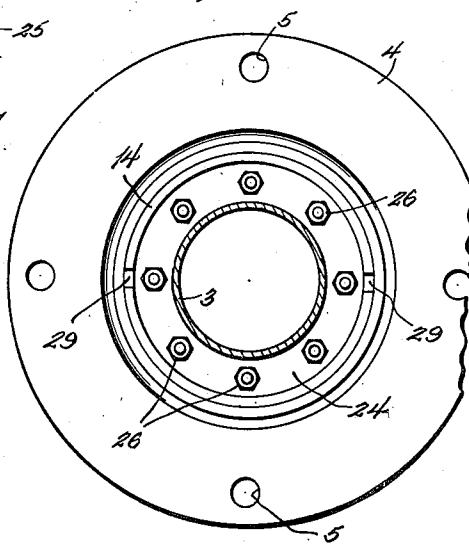


Fig. 4

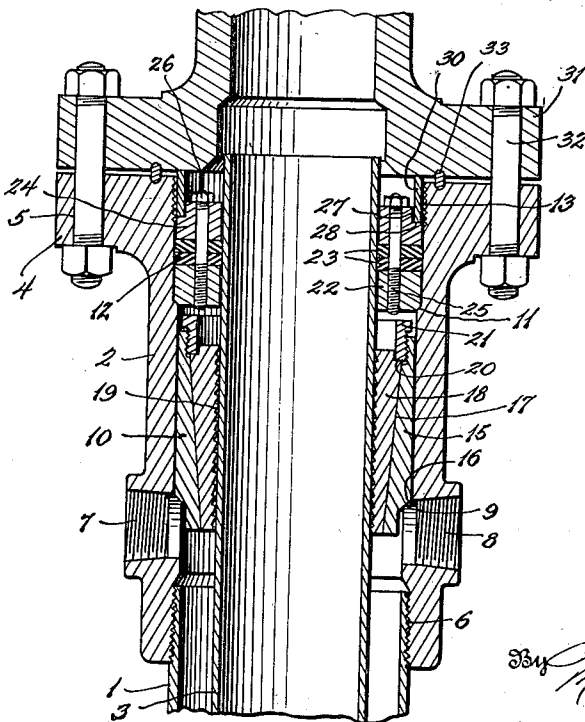
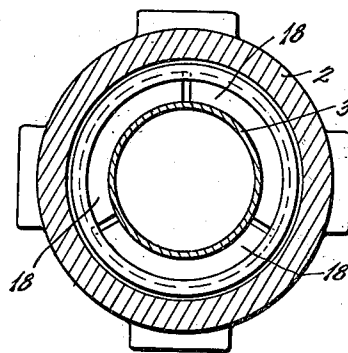


Fig. 3



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WELL CONTROL HEAD

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6 Claims. (Cl. 285—22)

This invention relates to oil well construction, and has for its general object the provision of novel means for suspending and sealing an inner casing with respect to a casing head.

One of the specific objects of the invention is to provide a slip bowl unit comprising a bowl and slips which can be secured to the inner casing at any desired position to seat in the casing head when the inner casing is set, and which may be withdrawn from the casing head as a unit on the inner casing when the latter is drawn up, so that the position of the slip bowl unit can be changed if it is desired to alter the depth to which the inner casing is to be set.

Another object of the invention is to provide a packing unit about the inner casing above the slip bowl unit and between the inner casing and casing head expansible readily into sealing contact both with the inner casing and the casing head by longitudinal pressure positively applied.

A further object of the invention is to provide means for holding said packing unit from being displaced longitudinally through the development of excess pressure between the casings.

Other objects of the invention will appear as the following description of a preferred and practical embodiment thereof proceeds.

In the drawing throughout the several figures of which the same characters of reference have been employed to designate identical parts:

Figure 1 is an axial section through the upper part of a well construction illustrating the suspending and sealing principles of the subject invention;

Figure 2 is a top plan view, part being broken away, the inner casing being shown in section;

Figure 3 is a cross-section taken in the plane of the line 3—3 of Figure 1;

Figure 4 is an axial section showing a slightly modified form of the invention.

Referring now in detail to the several figures, the numeral 1 represents an outer casing 1, having the casing head 2 secured to its upper end. It is assumed that the casing 1 has been cemented at its lower end into the bore, and that drilling has proceeded to the desired depth, the drill tools having been let down through the casing head and through the customary blow-out preventers, not shown. It is now desired to set the inner casing 3 to the proper depth within the freshly drilled bore.

Referring to the casing head, it comprises a tubular body having the flange 4 at its upper end with the bolt holes 5 for securing thereto any desired piece of accessory or permanent equip-

ment. The lower end of the bore of the casing head, as shown, is provided with a threaded zone 6, affording means for securing the casing head to the outer casing 1. Above the threaded zone are the lateral threaded openings 7 and 8 adapted either to be closed by a bull plug, not shown, or connected to suitable flow lines, not shown. Above the openings 7 and 8 the interior bore of the casing head is provided with an upwardly facing beveled annular shoulder 9 affording a seat for the slip bowl unit, which in general is designated by the reference character 10. Above the beveled shoulder 9 the bore of the casing head is cylindrical up to a level above the slip bowl unit where it is provided with an upwardly facing beveled shoulder 11 forming a seat for the packing unit, which in general, is designated by the reference character 12. In a zone which surrounds the upper end of the packing unit the bore of the casing head is provided with threads 13 for a follower ring 14, which secures the packing unit against longitudinal displacement.

The slip bowl unit 10 is here shown as seating upon the shoulder 9 in the position which it occupies when the inner casing 3 is either in a tentative or final set position. The slip bowl unit comprises a slip bowl 15 having an exterior downwardly facing annular shoulder 16 adapted to seat upon the shoulder 9 of the casing head. Above and below the shoulder the slip bowl 15 is cylindrical and a free fit within the bore of the casing head. The slip bowl 15 has an interior downwardly tapered bore 17 extending from the lower end of said slip bowl to a point adjacent to but below its upper end. A plurality of segmental wedge-like slips 18 seat within the slip bowl, their outer surfaces being of conical taper corresponding to the taper of the bore 17 of the slip bowl, and their inner surface being cylindrical, corresponding to the curvature of the inner casing 3. The inner surfaces of the slips are preferably serrated, as shown at 19, for the purpose of efficiently gripping the inner casing. The upper ends of the slips 18 are externally rabbeted, forming an external shoulder 20. The upper portion of the bore of the slip bowl is threaded to receive a ring nut 21 which screws down upon the shoulders 20 of the slips, forcing them downwardly into secure gripping relation with the inner casing 3 and retaining them within the slip bowl 15, in the event that the inner casing is raised.

It will be understood that before the inner casing 3 is finally set to the desired depth it is frequently tentatively set and then lifted one or

more times in order to change the depth to which it is to be set, by adjusting the slip bowl unit longitudinally with respect to the upper end portion of the inner casing. If the slips were not positively retained within the slip bowl 15 while they would securely suspend the inner casing through the wedging action induced by the gravitational pull of said inner casing, when the latter is lifted, the slips would come out independently of the slip bowl, leaving the latter on its seat 9 in the casing head. By positively securing the slips within the slip bowl and in gripping contact with the inner casing, the slip bowl as a unit is withdrawn from the casing head when the inner casing is lifted.

In applying the slip bowl unit to the inner casing, the slip bowl may be lowered over the outer end of the inner casing 3 while said outer end is outside of the blow-out preventers. It may be there held while the slips are put in place, and the ring nut 21 securely tightened. The inner casing 3 may then be let down through the blow-out preventers until the slip bowl is seated upon the shoulder 9, which position of the slip bowl determines the depth to which the inner casing is set. If it be required to change the position of the slip bowl unit relative to the inner casing 3, the latter is raised, elevating the slip bowl unit through the blow-out preventers. The slip bowl unit may then be disassembled by loosening or removing the ring nut 21, the slips loosened, and the slip bowl unit shifted to the desired position and then re-tightened about the inner casing.

When the slip bowl unit and inner casing are in the position shown in Figure 1, it is obvious that there is no gas-tight connection between the slip bowl unit and either the inner casing 3 or the casing head which would prevent the escape of gas developing in the space between the inner and outer casing. In order to seal the well against the escape of such gas, the packing unit 12 has been provided which comprises a junk ring 22 seating upon the shoulder 11 in the upper part of the casing head, the expansible washers 23 on top of the junk ring 22, and the gland 24 on top of the expansible members. The junk ring 22 and gland 24 are preferably of metal. The pile of packing elements thus described are provided with aligned bolt holes therethrough, receiving the bolts 25, which as shown, thread into the junk ring and have nuts 26 bearing against the gland 24. By tightening the nuts 26, the expansible packing washers 23 are subjected to clamping pressure, which expands them radially both inwardly and outwardly, respectively, against the inner casing 3 and the casing head 2. Thus, an efficient gas seal is maintained, the sealing pressure of which can be modified from time to time as may be desired, by adjusting the nuts 26. If at any time it is necessary to remove the packing unit 12, the nuts can be loosened, causing the expansible packing elements 23 to retract from the surfaces of the inner casing 3 and casing head 2, which they engage.

In order to safeguard the packing unit 12 from being displaced or blown out longitudinally, through the development of excess pressure between the inner and outer casings, the ring nut 14 has been provided which screws into the threaded upper end of the bore of the casing head into an annular recess 27 on the outer side of the gland 24 and presses against a shoulder 28 on said gland, defined by said recess. The upper end of the ring nut is preferably flush with the upper end of the casing head and has two receiv-

ing notches 29, by means of which it may be screwed in or out.

In Figure 4 a slightly modified form of the invention is shown, in which the ring nut 14 is substituted by an unthreaded retainer ring 30 which seats upon the shoulder 28 and has its upper end extending slightly above the top of the casing head 2. The flanged end 31 of a piece of equipment secured to the upper end of the casing head presses against the upper end of the retainer ring 30 under pressure developed by the bolts 32 which secure the flange 31 to the flange 4 of the casing head. The usual annular packing ring 33 is seated in matching channels on the confronting 15 faces of the flanges 4 and 31.

While we have in the above description disclosed what we believe to be a preferred and practical embodiment of the invention, it will be understood to those skilled in the art that the specific details as shown and described, are by way of example and not to be construed as limiting the scope of the invention which is defined in the appended claims.

What we claim as our invention is:

25 1. Casing control head for oil wells comprising a casing head having a seating shoulder for a slip bowl on the wall of its bore and a slip bowl unit for suspending an inner casing comprising a slip bowl with complementary exterior 30 seating shoulder adapted to seat on said casing head shoulder, said slip bowl having an interior downwardly tapering bore adapted to coaxially surround the inner casing, a plurality of slips within said bore having outer surfaces corre- 35 sponding in taper to the taper of said bore and inner cylindrical faces corresponding in curvature to that of the inner casing, and a ring nut screwing into the upper end of said bowl against the upper ends of said slips for forcing them 40 wedgingly between said bowl and inner casing and retaining them in said bowl.

2. Casing control head for oil wells comprising in combination a casing head adapted to be secured to the upper end of an outer casing, a 45 slip bowl unit for suspending an inner casing within said outer casing and in spaced relation thereto, said casing head having a bore of stepped diameters including upper and lower cylindrical portions respectively of relatively large and 50 smaller diameters, each with an inwardly extending upwardly facing shoulder at its lower end, said slip bowl unit including slips for engaging the inner casing, seated on the lower shoulder, the upper end of said slip bowl unit being below 55 the upper shoulder, an inner casing coaxially suspended by said slip bowl unit extending above the upper end thereof, and a packing unit in said casing head removable therefrom as a whole, seated upon the upper shoulder and surrounding said inner casing having packing elements radially expansible into sealing pressure with said 60 casing head and the inner casing and means for retaining said packing unit upon its seat in said casing head.

3. Casing control head for oil wells comprising in combination a casing head adapted to be secured to the upper end of an outer casing, a 65 slip bowl unit for suspending an inner casing within said outer casing and in spaced relation thereto, said casing head having a bore of stepped diameters including upper and lower cylindrical portions respectively of relatively large and 70 smaller diameters, each with an inwardly extending upwardly facing shoulder at its lower end, said slip bowl unit including slips for en- 75

gaging the inner casing, seated on the lower shoulder, the upper end of said slip bowl unit being below the upper shoulder, an inner casing coaxially suspended by said slip bowl unit extending above the upper end thereof, and a packing unit in said casing head removable therefrom as a whole, seated upon said upper shoulder comprising upper and lower clamping members with interposed compressible radially expansible washers, means accessible from the upper end of said packing unit for applying clamping pressure to said washers through said clamping members for expanding said washers radially into sealing contact with said casing head and said inner casing and means for retaining said packing means upon its seat in said casing head.

4. Casing control head for oil wells comprising in combination a casing head adapted to be secured to the upper end of an outer casing, a slip bowl unit for suspending an inner casing within said outer casing and in spaced relation thereto, said casing head having a bore of stepped diameters including upper and lower cylindrical portions respectively of relatively large and smaller diameters, each with an inwardly extending upwardly facing shoulder at its lower end, said slip bowl unit including a bowl having slips engaging the inner casing, seated on the lower shoulder, the upper end of said slip bowl unit being below the upper shoulder, an inner casing coaxially suspended by said slip bowl unit extending above the upper end thereof, and a packing unit in said casing head

comprising a junk ring seated upon said upper shoulder, compressible radially expansible washers on said junk ring and a follower ring upon said washers, and bolts threaded in said junk ring extending through said washers and follower ring having nuts accessible from the upper end of said packing unit for applying clamping pressure to said washers through said follower ring for expanding them radially into sealing contact with said casing head and said inner casing and means for retaining said packing unit upon its seat in said casing head.

5. Casing control head as claimed in claim 3, the upper end portion of the wall of the bore of said casing head being threaded, said retaining means comprising a ring screwing into said threaded portion into engagement with the upper end of said packing unit.

6. Casing control head as claimed in claim 3, the upper member of said packing unit having a peripheral rabbet defining an upwardly facing shoulder, said retaining means comprising a ring freely entering the upper end of the bore of said casing head resting upon said shoulder, said ring projecting above the plane of the upper end of said casing head, a well completion member on the upper end of said casing head bearing upon said ring and means for securing said well completion member to said casing head and in clamped relation to said ring for retaining said packing unit upon its seat within said casing head.

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