March 11, 1947. J. C. SANDILANDS 2,417,181

OIL WELL PRESSURE CONTROL SYSTEM

Filed June 8, 1942 3 Sheets-Sheet 1

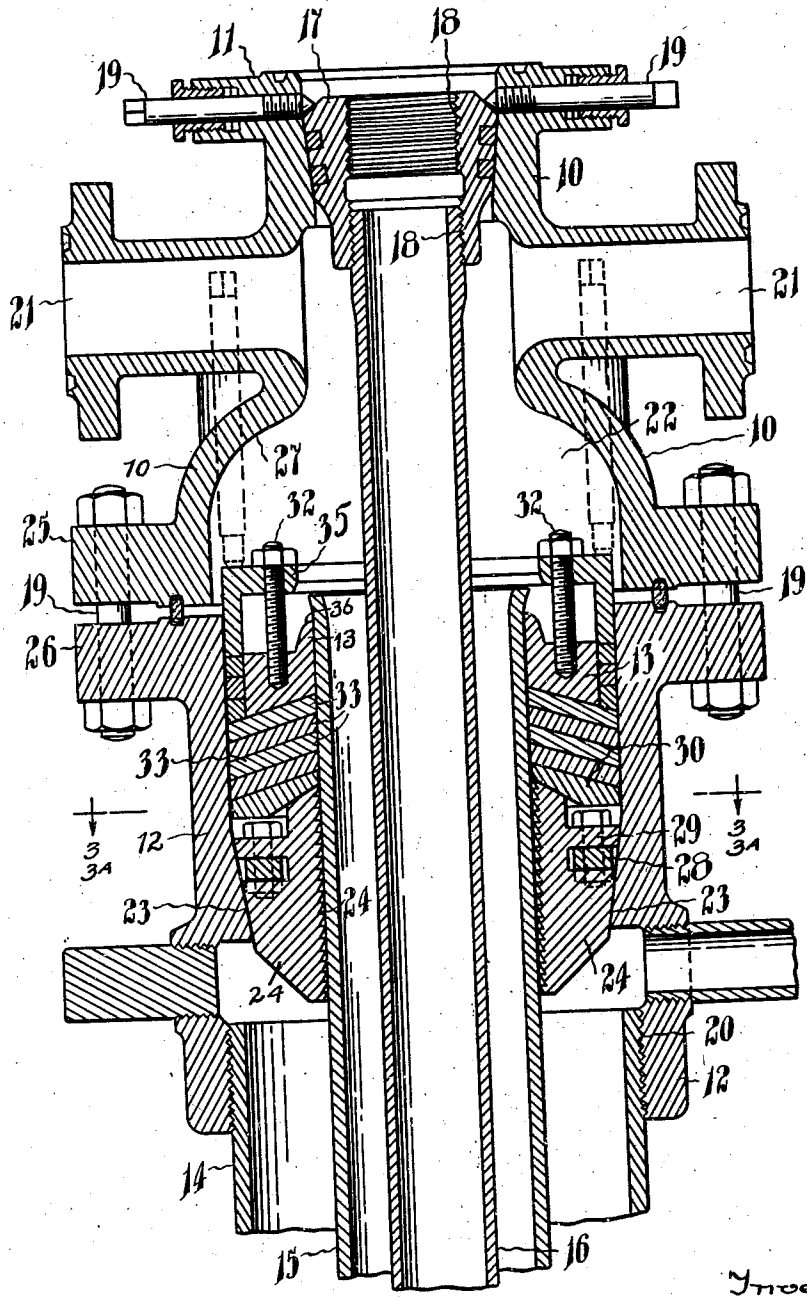


Fig. 1.

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March 11, 1947. J. C. SANDILANDS 2,417,181

OIL WELL PRESSURE CONTROL SYSTEM

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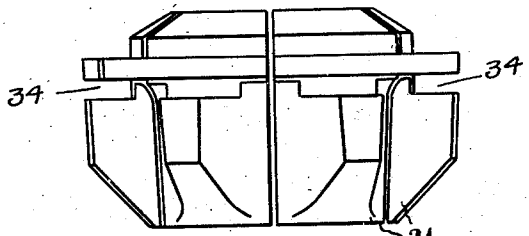


Fig. 2.

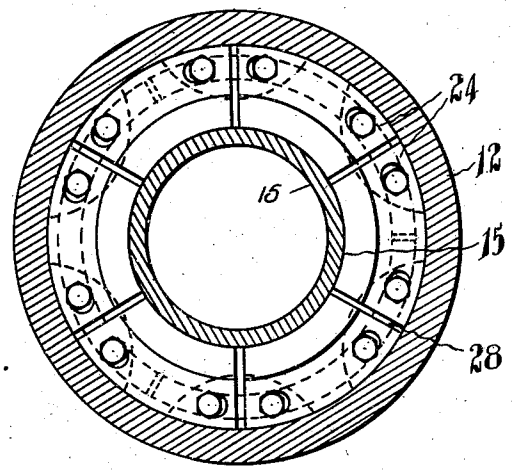


Fig. 3.

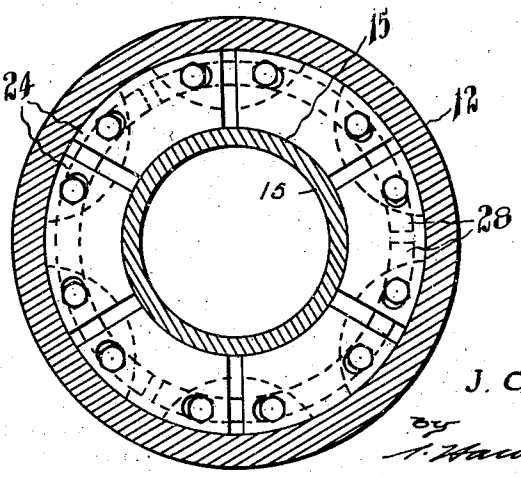


Fig. 3.A

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March 11, 1947. J. C. SANDILANDS 2,417,181

OIL WELL PRESSURE CONTROL SYSTEM

Filed June 8, 1942 3 Sheets-Sheet 3

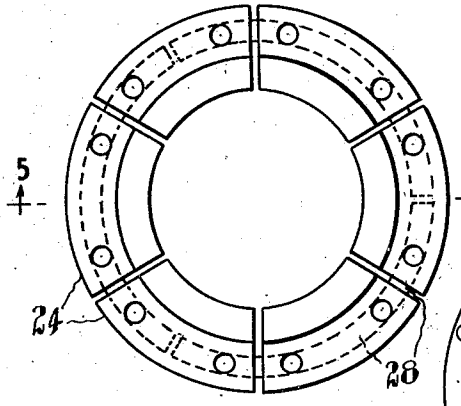


Fig. 4.

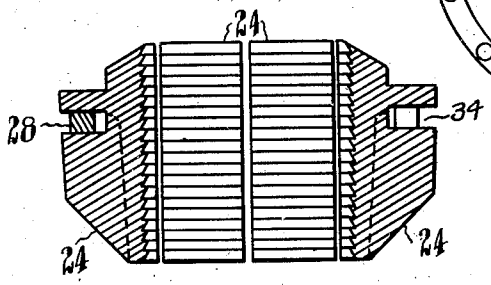


Fig. 5.

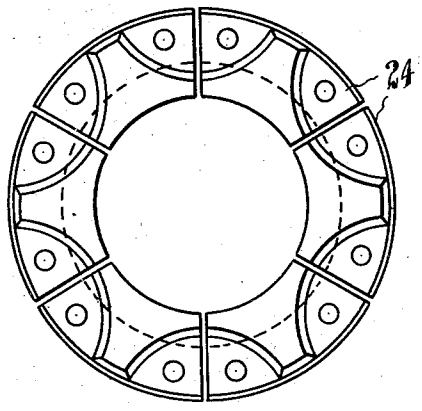


Fig. 6.

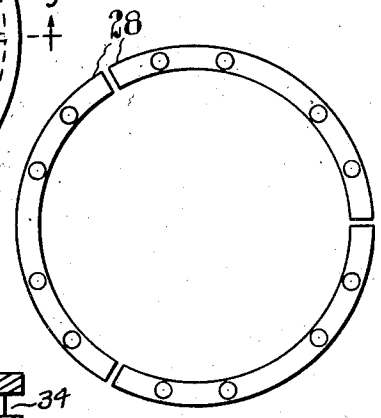


Fig. 7.

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UNITED STATES PATENT OFFICE

2,417,181

OIL WELL PRESSURE CONTROL SYSTEM

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Application June 8, 1942, Serial No. 446,248

5 Claims. (Cl. 166—14)

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This invention relates to an oil well pressure control system or well head and is particularly directed to providing improvements in the arrangement by means of which the intermediate casing is carried by the casing head in its fixed position in the oil well.

One of the difficulties in the present oil well pressure control systems is that of providing a firm and permanent gripping connection between the intermediate casing and the casing head, by means of which the heavy intermediate casing is held firmly in its fixed position by the casing head and in exact alignment therewith. The intermediate casing is usually secured to the casing head by means of slips having serrated teeth, the slips being wedged between the intermediate casing and the casing head. The outside diameter of the intermediate casing is, however, subject to considerable variation within manufacturing tolerances, and in using a conventional set of four slips, the slips do not conform with the outer surface of the intermediate casing with the result that there is not sufficient gripping contact between the outside surface of the casing and the serrated surface of the slips. For example, when the diameter of the casing is slightly larger than the diameter of the circular serrated surface of the slips, only the serrated surfaces at the edges of the slips are in gripping contact with the surface of the casing. Alternatively, if the diameter of the outer surface of the intermediate casing is slightly smaller than that of the serrated surface of the slips, only the central parts of the serrated surface of the slips are in gripping contact with the surface of the casing. Where the gripping contact between the serrated surface of the slips and the outer surface of the intermediate casing is insufficient, the casing may be deformed or may tear loose thereby putting all the load of the casing on the weld, or other connection, joining the casing to the landing head.

One of the principal objects of the present invention is to increase the number of serrated slips employed in supporting the intermediate casing from the casing head thereby dividing the inner surface of the slips into smaller segments, making possible uniform contact between the entire serrated surfaces of the slips and the outer surface of the intermediate casing, regardless of

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variations in the diameter of the intermediate casing.

A further problem in assembling the parts of the apparatus arises from the difficulty of maintaining the slips in exact vertical alignment with each other as the slips are being lowered into position.

A further object of the invention, therefore, is to provide a simple but very effective arrangement of parts by means of which the slips are brought into and held in exact vertical alignment as the intermediate casing is adjusted into its final permanent position.

A still further object of the invention is to increase the effective span of the packing space between the upper surface of the slips and the lower surface of the casing landing head without increasing the height of the casing head and without decreasing the height of the serrated surfaces of the slips.

An understanding of the objects of the present invention and the manner in which they are attained may be had from the following description and accompanying drawings, in which:

Figure 1 is a cross-sectional front elevation of an oil well pressure control system incorporating the present invention;

Figure 2 is a side elevation of an outer view of the slips;

Figure 3 is a cross-sectional top plan view taken along the line 3—3, Figure 1, showing the intermediate casing having a smaller diameter than that of the slips;

Figure 3a is a similar view of an intermediate casing having a larger diameter than that of the slips;

Figure 4 is a plan view of the slips;

Figure 5 is a cross-sectional elevation of the slips taken along the line 5—5, Figure 4;

Figure 6 is a plan view of the underside of the slips shown in Figure 5; and

Figure 7 is a plan view of the slip ring.

Like reference characters refer to like parts throughout the specification and drawings.

The oil well pressure control system illustrated in Figure 1 includes a vertically mounted tubing head 10, a tubing landing head 11, and a casing head 12, and an intermediate casing hanger head 13. The heads 10 and 12 are vertically mounted, one positioned on top of the other, and

are formed with an aligned centrally located chamber 22. The lower end of the tubing head 10 and the upper end of the casing head 12 are formed with outwardly extending flanges 25 and 26, respectively, which are secured together in fluid tight engagement by the bolts 19.

The lower end of the casing head is internally threaded, as indicated by the numeral 20, to receive the threaded upper end of the outer casing 14. The outer casing 14 usually extends downwardly into the well a distance of about 500 feet.

The upper end of the intermediate casing 15 extends into chamber 22 approximately the full height of the casing head 12 and is carried by that head in the manner described in detail hereinafter. The intermediate casing 15 is of less diameter than the outer casing 14 and extends downwardly through that casing, usually extending into the well a distance of about 4000 feet.

The tubing landing head 11, provided on the upper part of the tubing head 10, is formed with a vertical slightly tapered central opening into which is wedged the tapered inner casing or tubing hanger 17 which is drilled and tapped, as indicated at 18, to receive the threaded upper end of the inner casing or tubing 16. The hanger 17 is held firmly in its fixed position by the adjustable set screws 19. In ordinary practice, the inner casing or tubing extends downwardly through the intermediate casing 15 to the lowermost depths of the well, for example, from 6000 to 8000 feet.

Oil outlet ports 21 are located in the upper part of the tubing head 10 and are provided with the usual valve members (not shown) by means of which the flow of oil from the several casings is controlled.

The manner in which the intermediate casing 15 is carried by the casing head 12 constitutes one of the principal features of the present invention and is described in detail hereinafter.

The central chamber 22 formed by the bore of the heads 10 and 12 is of greater diameter than that of the intermediate casing 15 which extends into it. The upper walls of chamber 22 are curved inwardly, as indicated by the numeral 27, above the upper end of the intermediate casing 15, to provide a passageway for the oil flowing through the chamber 22 to the outlet ports 21. The walls of the lower end of the chamber are tapered inwardly as indicated by the numeral 23.

The intermediate casing 15 is held in its fixed position by the serrated inner surfaces of the slips 24 which form an annular ring around the outer surface of the intermediate casing. The slips 24 are wedged into the space between the wall of the intermediate casing and the tapered wall 23 of the chamber 22, the outer wall of each slip being tapered to conform with the tapering of the chamber wall 23.

I have found that by increasing the number of slips, it is possible to provide a gripping contact between all the serrated surfaces of the slips around the periphery of the outer surface of the intermediate casing, regardless of the variations in the diameter of the intermediate casing within manufacturing tolerances. This feature is shown in Figures 3 and 3*a* which illustrate the serrated surfaces of the slips in gripping contact with intermediate casing members, the diameter of which is larger and smaller, respectively, than standard. This complete gripping contact is effected by increasing the number of the slips and making it possible to shape the slips in smaller segments of a circle of the approximate average diameter of the intermediate casing.

The serrated surface of each slip is formed such that, in a vertical plane, the surface is in exact alignment with the intermediate casing and, in a horizontal plane, the surface is curved in a segment of a circle, the diameter of which is approximate to that of the average diameter of the intermediate casing. I have found that six slips are the minimum number which will bring all of the serrated surfaces of the slips in gripping contact with all parts of the surface of the intermediate casing over the area which the slips extend. This number of slips may be increased, if desired.

An aligning ring or slip ring 28 is fitted into the aligned grooves 34 cut in the outer walls of the slips. The slip ring 28 is preferably formed in three or more segments for convenience in passing around the casing and fitting into the grooves 34. Also, when formed in this manner, it permits freer horizontal movement of the slips. The slip ring 28 is drilled vertically at spaced intervals to receive the vertical retaining bolts 29. An outwardly extending flange formed on each slip may be drilled to receive the ends of the bolts 29. The holes in the slip ring and in the slips are aligned in such a manner that the slips are retained in exact alignment as they are being formed into an annular ring in their desired position around the outer surface of the intermediate casing. The bolt holes in the slip ring and slips are preferably made sufficiently larger than the bolts to permit the maximum horizontal movement of the slips.

A stuffing box ring 30 is inserted above the slips 24 and between the walls of the outer casing 15 and the walls of chamber 22. Packing rings 33 are inserted above the stuffing box ring 30 and the intermediate casing hanger head 13 is inserted above packing 33. The upper surfaces of each of rings 30 and 33 are convex in shape and the lower surfaces of rings 33 and hanger head 13 are concave in shape. The effective bearing surface is increased by forming the rings 30 and 33 and the lower surface of the hanger head 13 at an angle to the horizontal.

The upper end of the intermediate casing terminates in the hanger head 13 which is drilled to receive the packing studs 32 which pull on the packing gland 35 to adjust and to hold the packing rings in their fixed position while the apparatus is being assembled.

It has been found that this arrangement of packing more effectively seals the oil in chamber 22 and prevents the oil from escaping down the outer casing 14.

The upper end of the intermediate casing is joined to the hanger head 13, such as by welding, as indicated by the numeral 36.

In assembling the apparatus, the outer casing 14 is joined to the base of the casing head 12. The intermediate casing 15 is then lowered into position and the slips, retained in their aligned position by the slip ring 28, are lowered into their position in the lower part of chamber 22 and are retained, as they are lowered, in their circular position by the vertical retaining bolts 29 which pass through the aligning or slip ring 28. The serrated surfaces of the slips grip the outer surface of the casing and the weight of the casing causes the slips to be wedged tightly in their position in the lower part of the casing head, greater wedging effect causing increased gripping contact between the serrated surfaces of

the slips and the outer surface of the intermediate casing. The inner casing or tubing 16 is then lowered into place and the upper end joined to the tubing landing head 11 as described hereinbefore.

It has been found that by having the aligning or slip ring 28 extend horizontally, and by using vertically disposed retaining bolts, it is possible to increase the number of slips to such an extent that each slip forms only a very small segment of a circle, thereby ensuring that the entire serrated surface of each of the slips is in its proper position and all the slips form an annular ring, the entire serrated surface of which is in gripping contact with the outer surface of the intermediate casing.

It has been found, also, that the increased vertical span of packing serves to prevent more positively the possibility of any of the oil in the chamber 22 escaping from that chamber except through the outlet lines provided for that purpose.

What I claim as new and desire to protect by Letters Patent of the United States is:

1. In an oil well pressure control system, a casing head, a chamber in said casing head, the lower wall of said chamber being tapered inwardly, a casing extending into said chamber, means for anchoring said casing in said casing head which comprises a plurality of slips tapered to fit snugly into the lower part of the said chamber between the tapered wall thereof and the wall of the casing extending thereinto, each of said slips having a serrated inner surface and being formed in a segment of a circle to comprise part of an annular, wedge-like ring extending around and in gripping contact with the outer surface of said casing, and means for aligning the slips in their predetermined position comprising an annular ring formed of separate segments fitted into aligned grooves formed in the outer walls of the said slips and extending horizontally therearound, the segments being positioned simultaneously in aligned grooves in adjacent slips, the combination of the slips and the aligning ring being free to adjust itself within the chamber to the diameter of the casing.

2. In an oil well pressure control system, a casing head, a chamber in said casing head, the lower wall of said chamber being tapered inwardly, a casing extending into said chamber, means for anchoring said casing in said casing head which comprises a plurality of slips tapered to fit snugly into the lower part of the said chamber between the tapered wall thereof and the wall of the casing extending thereinto, each of said slips having a serrated inner surface and being formed in a segment of a circle to comprise part of an annular, wedge-like ring extending around and in gripping contact with the outer surface of said casing, and means for aligning the slips in their predetermined position comprising an annular ring formed of separate segments fitted into aligned grooves formed in the outer walls of the said slips and extending horizontally therearound, the segments being positioned simultaneously in aligned grooves in adjacent slips, and vertically disposed retaining bolts passed through the said aligning ring into aligned holes in said slips, the combination of the slips and the aligning ring being free to adjust itself within the chamber to the diameter of the casing.

3. In an oil well pressure control system, a casing head, a chamber in said casing head, the lower wall of said chamber being tapered inwardly, a casing extending into said chamber, means for anchoring said casing in said casing head which comprises a plurality of slips tapered to fit snugly into the lower part of the said chamber between the tapered wall thereof and the wall of the casing extending thereinto, each of said slips having a serrated inner surface and being formed in a segment of a circle to comprise part of an annular, wedge-like ring extending around and in gripping contact with the outer surface of said casing, and means for aligning the slips in their predetermined position comprising an annular ring formed of separate segments fitted into aligned grooves formed in the outer walls of the said slips and extending horizontally therearound, the segments being positioned simultaneously in aligned grooves in adjacent slips, the combination of the slips and the aligning ring being free to adjust itself within the chamber to the diameter of the casing, and packing rings angularly disposed to said slips and positioned between said slips and the top of the casing, and means for adjusting and holding said packing rings in their predetermined, angularly disposed position.

4. In an oil well pressure control system, a casing head, a chamber in said casing head, the lower wall of said chamber being tapered inwardly, a casing extending into said chamber, means for anchoring said casing in said casing head which comprises a plurality of slips tapered to fit snugly into the lower part of the said chamber between the tapered wall thereof and the wall of the casing extending thereinto, each of said slips having a serrated inner surface and being formed in a segment of a circle to comprise part of an annular, wedge-like ring extending around and in gripping contact with the outer surface of said casing, and means for aligning the slips in their predetermined position comprising an annular ring formed of separate segments fitted into aligned grooves formed in the outer walls of the said slips and extending horizontally therearound, the segments being positioned simultaneously in aligned grooves in adjacent slips, the combination of the slips and the aligning ring being free to adjust itself within the chamber to the diameter of the casing, and packing rings angularly disposed to said slips and positioned between said slips and the top of the casing, and means for adjusting and holding the packing rings in their predetermined, angularly disposed position.

5. In an oil well pressure control system, a casing head, a chamber in said casing head, the lower wall of said chamber being tapered inwardly, a casing extending into said chamber, means for anchoring said casing in said casing head which comprises a plurality of slips tapered to fit snugly into the lower part of the said chamber between the tapered wall thereof and the wall of the casing extending thereinto, each of said slips having a serrated inner surface and being formed in a segment of a circle to comprise part of an annular, wedge-like ring extending around and in gripping contact with the outer surface of said casing, and means for aligning the slips in their predetermined position comprising an annular ring formed of separate segments fitted into aligned grooves formed in the outer walls of the said slips and extending horizontally therearound, the segments being positioned simultaneously in aligned grooves in adjacent slips, and vertically disposed retaining bolts passed through the said aligning ring into

aligned holes in said slips, the combination of the slips and the aligning ring being free to adjust itself within the chamber to the diameter of the casing, and packing rings angularly disposed to said slips and positioned between said slips and the top of the casing, and means for adjusting and holding the packing rings in their predetermined, angularly disposed position.

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