Dec. 22, 1942. A. J. PENICK ET AL 2,306,102

CASING HEAD

Filed Feb. 17, 1941 2 Sheets-Sheet 1

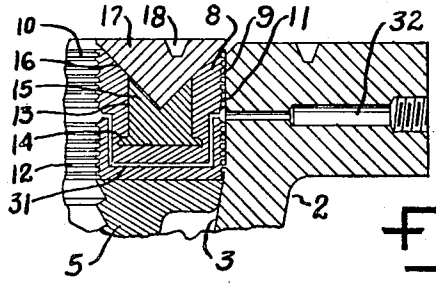


Fig. 3.

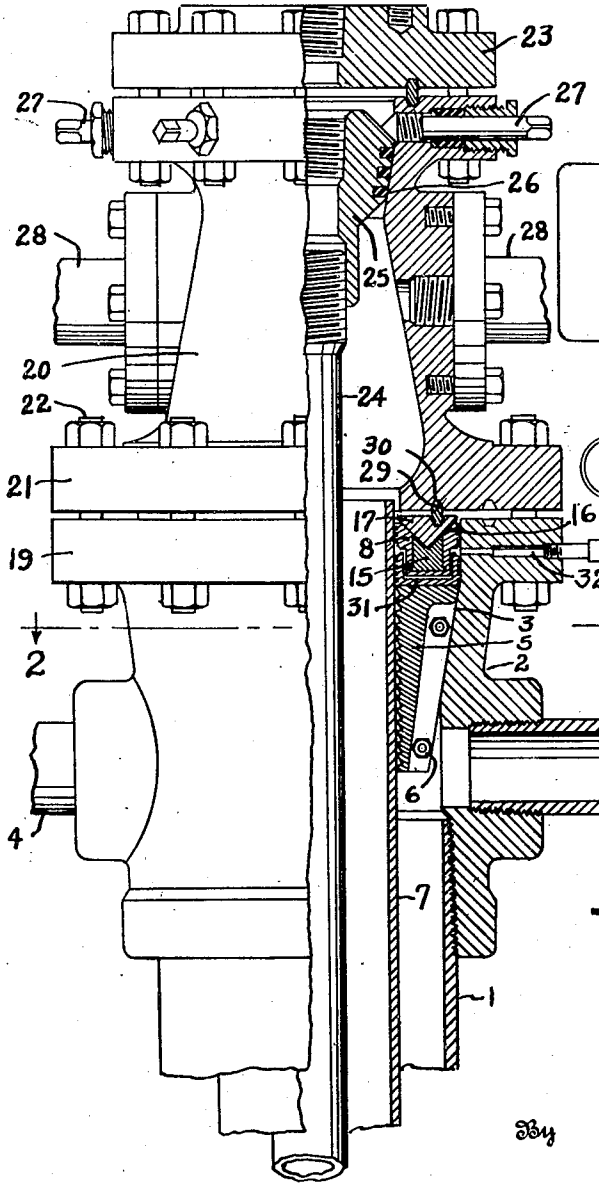


Fig. 1.

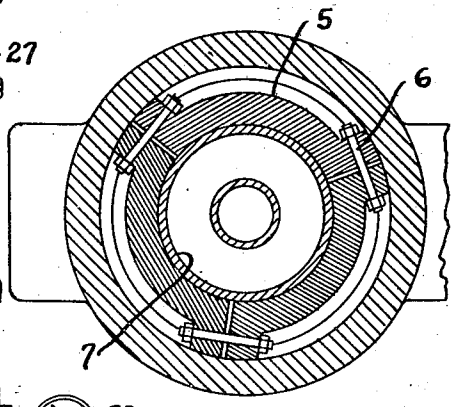


Fig. 2.

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Filed Feb. 17, 1941 2 Sheets-Sheet 2

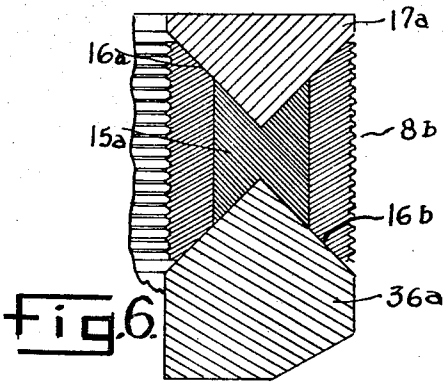


Fig. 6.

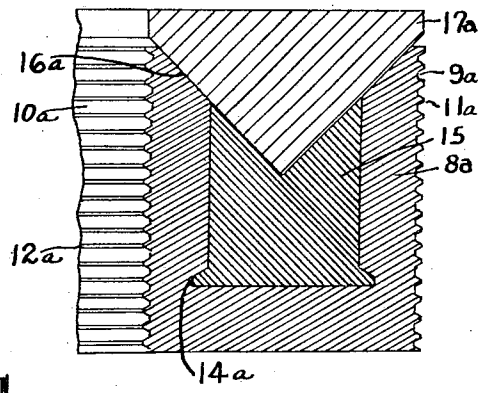
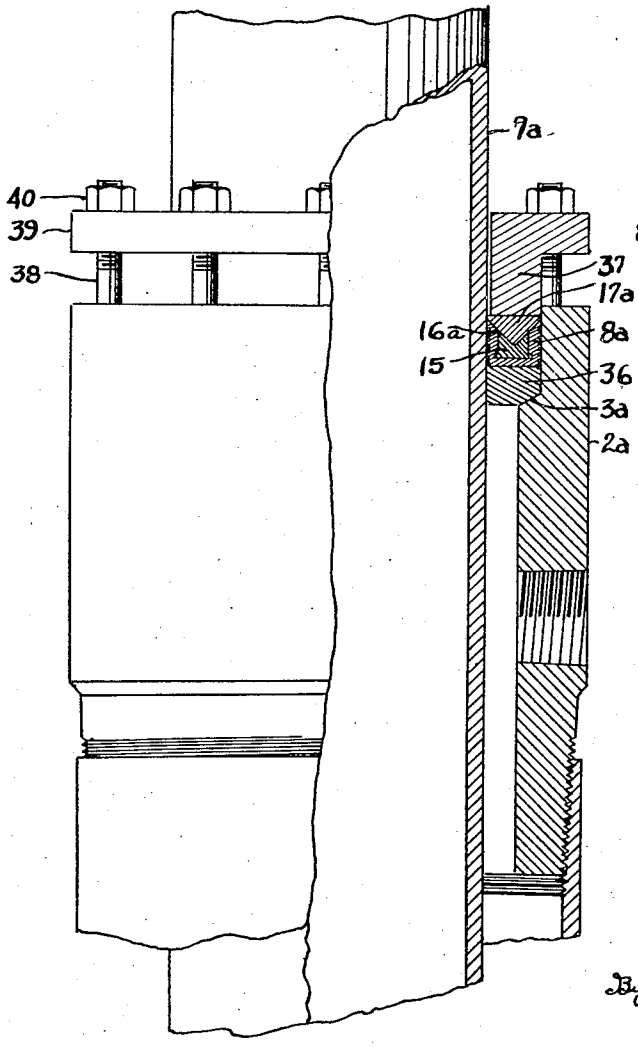


Fig. 5.



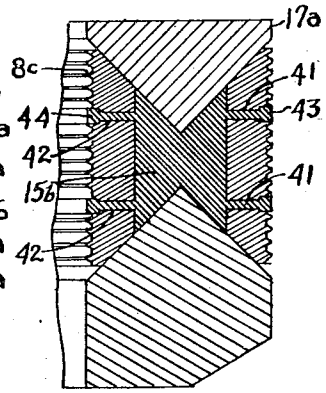


Fig. 7.

Fig. 4.

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UNITED STATES PATENT OFFICE

2,306,102

CASING HEAD

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Application February 17, 1941, Serial No. 379,224

7 Claims. (Cl. 166—14)

This invention relates to a casing head and more particularly to a novel type of sealing means between the casing head and an inner pipe through the head.

An object of the invention is to provide a novel type of seal ring adapted to be arranged between an outer head and an inner pipe through the head, said seal ring being expansible so as to form a fluid-tight joint between the seal ring and the head as well as between the seal ring and the inner pipe.

Another object of the invention is to provide a novel type of seal ring shaped to be located between outer and inner parts, said seal ring being expansible and being of such formation as to form seals between it and said outer and inner parts when the seal ring is expanded.

More specifically the invention relates to a novel type of expansible metallic seal ring having external annular ribs with means for expanding the seal ring.

The invention also embodies means for testing the outer and inner seals for leakage.

With the above and other objects in view the invention has particular relation to certain novel features of construction, arrangement of parts and use, examples of which are given in this specification and illustrated in the accompanying drawings, wherein:

Figure 1 shows a side elevation of the assembly partly in section.

Figure 2 shows a cross-sectional view taken on the line 2—2 of Figure 1.

Figure 3 shows an enlarged, fragmentary, vertical sectional view.

Figure 4 shows a side elevation, partly in section, of another embodiment of the assembly.

Figure 5 shows an enlarged, fragmentary, sectional view showing the type of seal ring shown in Figure 4.

Figure 6 shows an enlarged, sectional view of another embodiment of the seal ring, and

Figure 7 shows an enlarged, sectional view of still another embodiment.

Referring now more particularly to the drawings wherein like numerals of reference designate the same parts in each of the figures the numeral 1 designates an outer casing in the well attached to the upper end of which there is a casing head 2 which is formed with the inside downwardly tapering seat 3 and which is provided with outflow lines as 4 beneath said seat.

On the seat 3 are the slips 5 which are shown in three sections although a greater or less number of sections may be employed. These slip sections are bolted together, by the bolts 6, around the inner pipe 7 and when the pipe is lowered through the casing head 2, as hereinafter explained, the slips will land on the seat 3 and will be sufficiently contracted by the seat so as to be in secure gripping relation with the pipe 7. The upper end of this pipe terminates above the casing head as shown in Figure 1.

Surrounding the upper end of the inner well pipe 7 and fitting closely between it and the inside of the casing head 2, there is a seal ring 8. This is preferably a continuous ring. It is supported upon the upper ends of the slips 5 and is preferably formed of metal.

As clearly illustrated in Figure 3 the seal ring is preferably formed with external and internal annular grooves 9 and 10 with intervening external and internal annular ribs 11 and 12 between said grooves.

As clearly shown in Figures 1 and 3 the pipe supporting slips 5 also have the inside teeth to engage the inner pipe.

In a preferred form of the invention the seal ring 8 has an inside, deep, annular groove 13 extending entirely around it. The bottom of the groove is preferably enlarged, or flared each way as indicated at 14. This groove is preferably filled with a deformable material such as 15. This filling material, or core, 15 may be formed of lead or other suitable deformable material.

The upper side of the seal ring as thus formed has a V-groove 16 extending entirely around it said V-groove extending also into the core 15.

An annular wedge ring 17 is fitted into this V-groove and is preferably formed with a flat upper surface having an annular seat 18 thereabout.

The upper end of the casing head 2 is formed with an external annular flange 19.

In the embodiment illustrated in Figure 1, a tubing head 20 is mounted on the casing head having the lower end flange 21 which is bolted to the casing head flange by means of the bolts 22.

Bolted onto the upper end of the tubing head there may be provided a suitable connection 23 for the mounting of the christmas tree thereon. A tubing 24 is suspended from the tubing head by means of a suitable hanger 25 which is seated in a downwardly tapering seat 26 in the tubing head and which may be held down by suitable lockdown screws as 27 threaded through the tubing head.

The tubing head is also provided with outflow lines 28 beneath the hanger.

Before the tubing head is mounted on the casing head the slips 5 may be secured around the upper end of the inner pipe 7 and said pipe then lowered into the well until the slips land on the seat 3 and thereafter form a support for the inner pipe 7. The seal ring assembly, as illustrated in Figures 1 and 3, may then be fitted within the casing head around the inner pipe 7 and seated on the slips. The tubing head may then be mounted in place with an annular gasket 29 seated in the groove 18 and in a registering groove 30 in the lower end of the tubing head. When the tubing head is bolted in place, pressure will be applied through the gasket 29 to the wedge ring 17 and through said wedge ring to the seal ring causing the seal ring to expand to bring the ribs 11, 12 into close contact with the inner wall of the casing head and the external surface of the pipe 7, respectively, thus forming tight seals. The deformable material 15 when placed under pressure will assist in the expansion of the seal ring. The groove 13 is of such depth as to cause the seal ring to be expansible approximately throughout its vertical thickness so that approximately all of the outside and inside ribs 11 and 12 will be forced into sealing relationship with the casing head and inner pipe, respectively, thus forming a very efficient seal.

Fluid under pressure passing upwardly through the pipe 7 into the tubing head will, therefore, not find its way back between the casing and the inner pipe 7.

Before the installation is completed, however, it may be desirable to test the seals. For that purpose a channel 31 leads through the seal ring from its outer surface to its inner surface and the outer end of this channel is in registration with a radial channel 32 through the flange 19 of the casing head. A tubular connection 33 is screwed into the outer end of the channel 32 and its outer end is provided with a connection 34 by means of which a pump or pressure line may be connected to the connection 33. Fluid under pressure may be admitted through the channels 32, 31 so as to test both the outer and inner seals for leakage. The connection 33 is provided with a suitable pressure gage 35 for an obvious purpose.

When the seals have been tested the connection 33 may be detached and the installation of the well head completed.

In the embodiment illustrated in Figure 4 there is a tubular casing head 2a mounted on the upper end of the casing 1 and having an annular inside seat 3a upon which the inside ring 36 is located through which the inside pipe 7a extends. In this type of assembly the christmas tree or other flow connections may be mounted directly upon the upper end of the pipe 7a. Within the casing head 2a and supported on the ring 36 there is the seal ring 8a whose external construction is approximately the same as that of the seal ring 8 and which may contain the annular core 15 of soft metal. The seal ring 8a closely surrounds the inner pipe 7a and said ring has the V-groove 16a to receive the wedge ring 17a.

A gland 37 is fitted within the upper end of the casing head 2a against the wedge ring 17a.

Bolts 38 are secured to the upper end of the casing head 2a and extend through a top flange 39 of the gland and are outwardly threaded to receive the clamp nuts 40 whereby the gland may be clamped in place and pressure applied against the wedge ring 17a to cause the flow of the deformable material 15 and the expansion of the seal ring so that its outer and inner ribs 11a and 12a will be forced into sealing relationship with the inside of the tubing head 2a and the outside of the pipe 7a so as to form fluid-tight seals therewith.

Referring to Figure 6 the seal ring is indicated by the numeral 8b. In this form the central portion of the ring may be formed of deformable material 15a which may be composed of lead or other suitable deformable material. One end of this type of ring is formed with the V-groove 16a to receive the wedge 17a as shown also in Figure 5. The lower end of the seal ring 8b is also formed with an annular V-groove 16b. When this form of seal ring is used, the supporting ring 36a is formed to conform to the shape of it to fit closely in the groove 16b thus forming also a wedge ring.

In the embodiment illustrated in Figure 7 the seal ring 8c has the radial outwardly extended channels 41 and the inwardly extended channels 42 which terminate in outer and inner annular grooves 43, 44. In this form the deformable material 15b extends through the channels 41, 42 and into, and fills, the grooves 43, 44 so as to form annular lead seals.

When the type of seal ring shown in Figure 6 or Figure 7 is mounted in the casing head 2a and pressure applied thereto by the gland 37 the seal ring 8b, or 8c, as the case may be, will be expanded outwardly against the casing head and contracted inwardly against the pipe so as to form very close fitting seals to prevent leakage and furthermore when the seal ring 8c is employed the deformable material 15b when subjected to compression will flow out through the channels 41, 42 and force the lead seals 43, 44 into close contact with the casing head 2a and pipe 7a, respectively, thus forming very effective fluid tight seals.

The seal ring will be forced into such close-fitting relation with the casing head and with the inside pipe that it will not be necessary to weld said ring to either the casing head or to the pipe to form fluid-tight seals as is now sometimes practiced. Furthermore, the seal ring being formed of metal, will not be liable to deteriorate and permit leakage as would be the case were rubber or other similar packing material used.

The drawings and description are illustrative merely while the broad principle of the invention will be defined by the appended claims.

What we claim is:

1. A pipe seal for a well head having a pipe therein, including a rigid seal ring between the head and pipe having a soft metal core and having an annular groove therein and a wedge ring in the groove and means for applying pressure to the wedge ring to expand the core and thereby expand the seal ring into sealing relationship with the head and with the pipe approximately throughout the vertical length of the seal ring.

2. A pipe seal for a well head having a pipe suspended therein, including a metallic seal ring between the head and pipe formed of metal and having an annular core of deformable material and also having an annular groove, a wedge ring in the groove and means for applying pressure to the wedge ring and to the core to expand the latter to cause the seal ring to be forced into sealing relationship with the head and with the pipe.

3. In a device of the character described, a metal seal ring having a core of deformable material and means for applying endwise compression to the seal ring and core to cause expansion of said ring outwardly and contraction thereof endwardly.

4. In a device of the character described, a metal seal ring having V-grooves and wedge rings in said grooves whereby upon the application of endwise pressure to the wedge rings, the seal ring will be expanded outwardly and contracted inwardly.

5. In a device of the character described, a seal ring having a core of deformable material and having external and internal annular grooves and having channels through which said material may flow into said grooves, said seal ring having an annular, approximately V-shaped groove, a wedge ring in the groove to cause expansion of the seal ring and the flow of said deformable material through said channels upon the application of endwise pressure to the seal ring.

6. A pipe seal for a well head having a pipe suspended therein including a seal ring of rigid material between the head and pipe, said seal ring having an external annular groove and an internal annular groove and a channel connecting said grooves, means for expanding the seal ring outwardly and for contracting it inwardly to form a seal between the ring and head and a seal between the ring and pipe.

7. A pipe seal for a well head having a pipe suspended therein comprising a metal seal ring having external and internal annular ribs, a core of deformable material in the seal ring and means for applying endwise compression to the seal ring and core to cause expansion of the ring outwardly and contraction thereof inwardly to form a plurality of metal to metal seals between the ring and pipe and between the ring and head.

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