Dec. 5, 1950 J. E. ECKEL ET AL 2,532,662

WELL HEAD ASSEMBLY

Filed Feb. 12, 1948 5 Sheets-Sheet 1

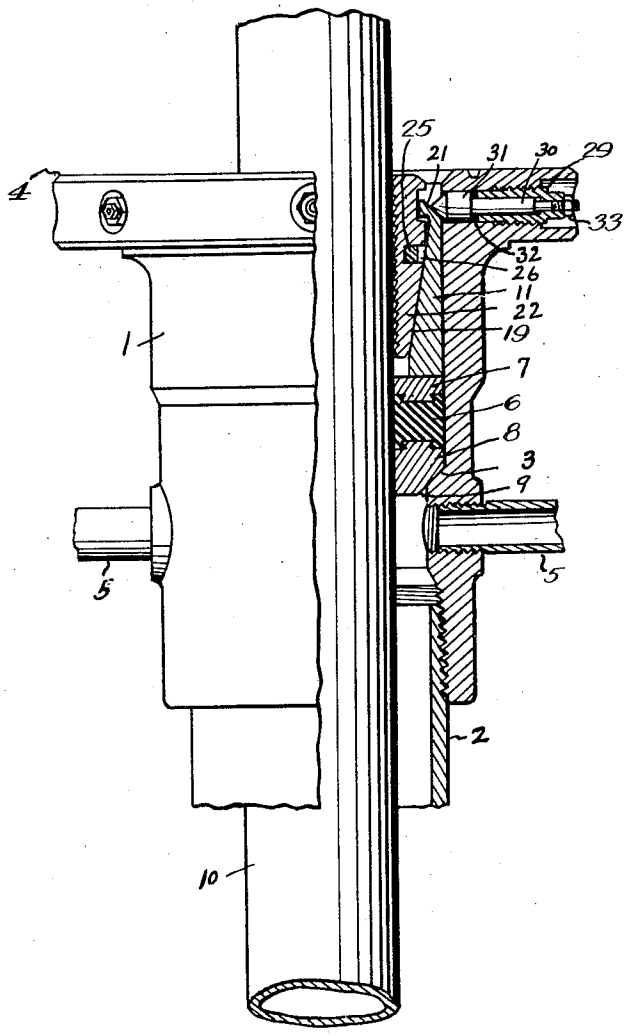


Fig. 1.

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WELL HEAD ASSEMBLY

Filed Feb. 12, 1948 5 Sheets-Sheet 2

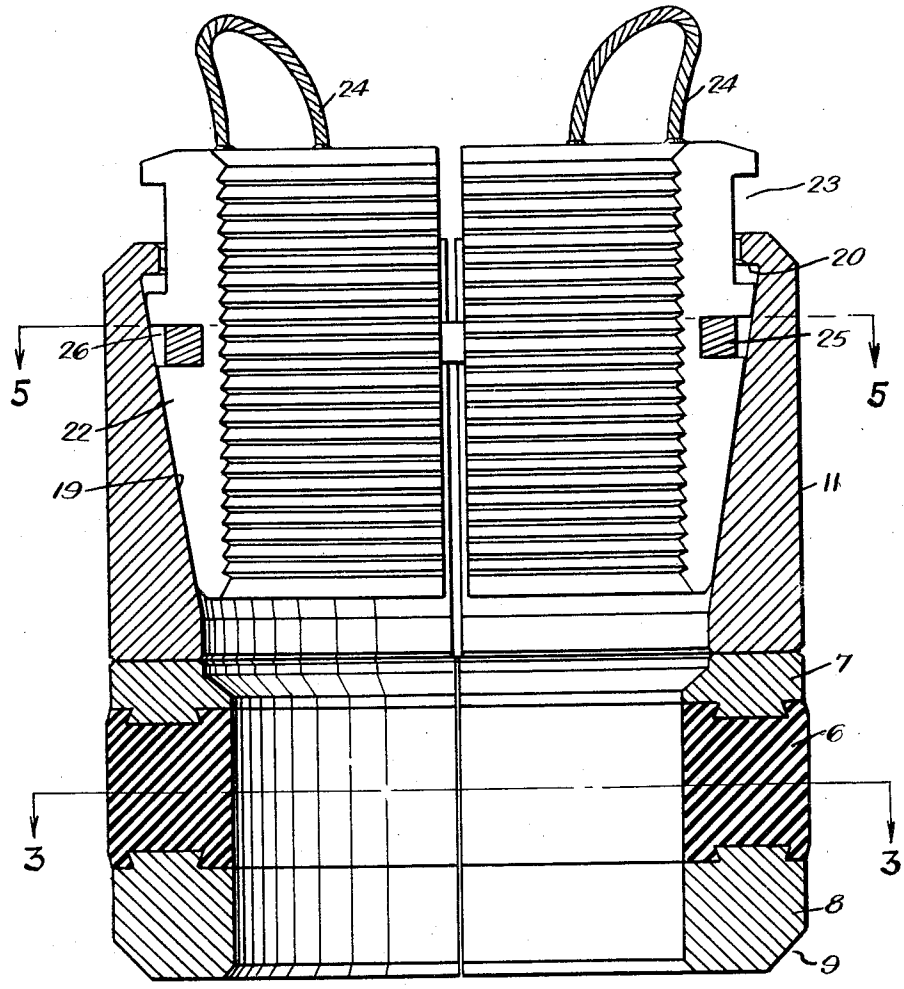


Fig. 2.

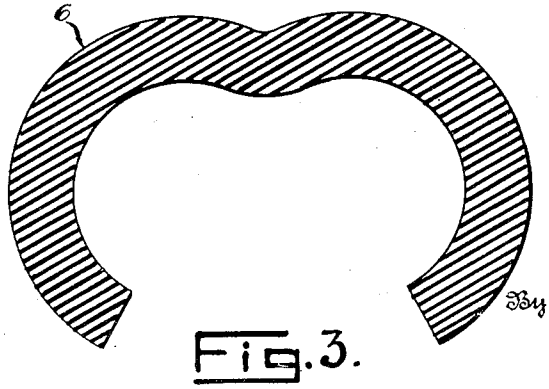


Fig. 3.

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WELL HEAD ASSEMBLY

Filed Feb. 12, 1948 5 Sheets-Sheet 3

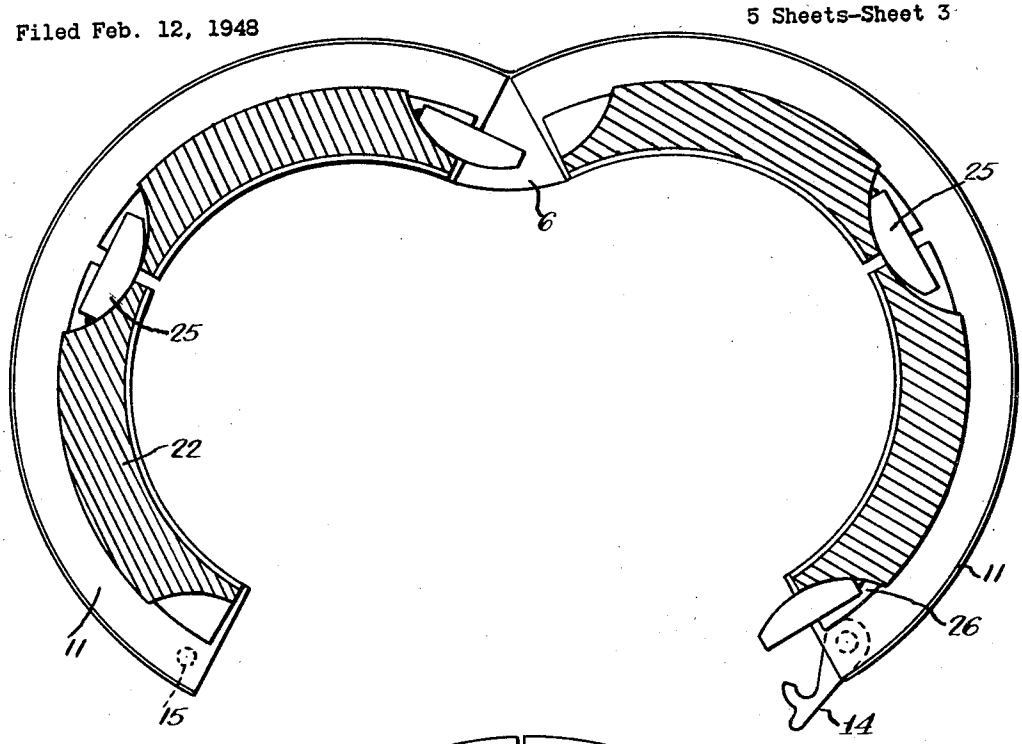


Fig. 5.

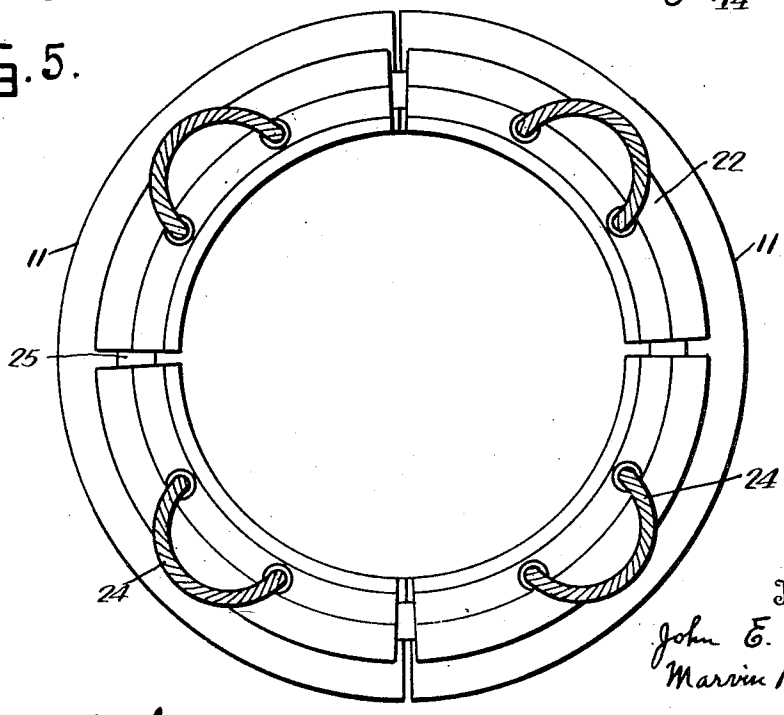


Fig. 4.

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WELL HEAD ASSEMBLY

Filed Feb. 12, 1948 5 Sheets-Sheet 4

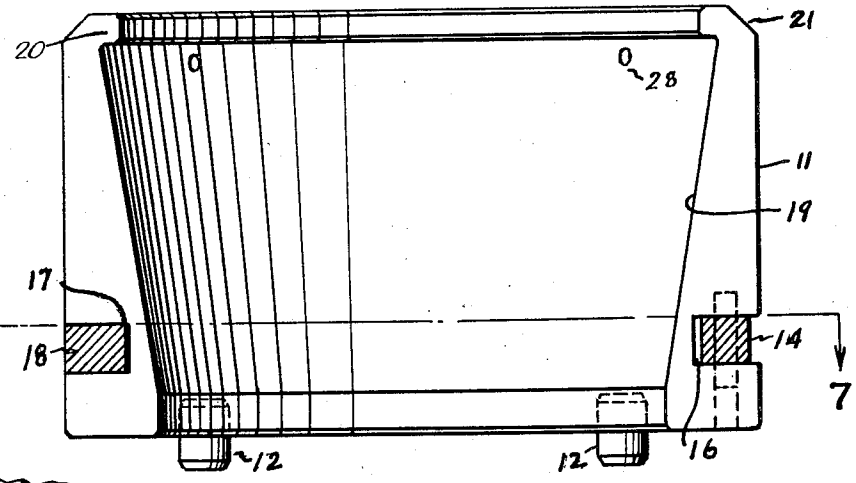


Fig. 6.

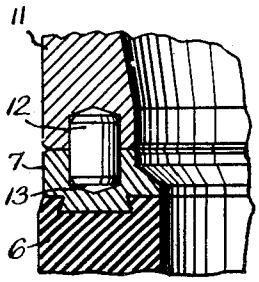


Fig. 8.

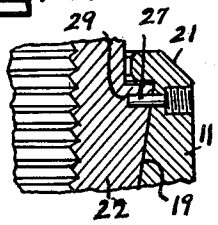


Fig. 9.

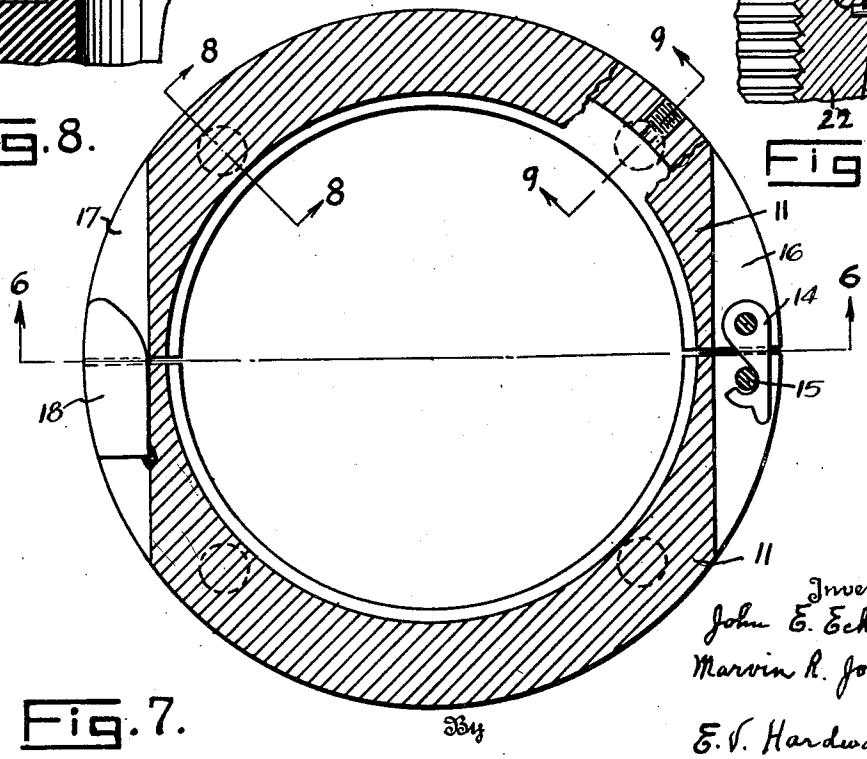


Fig. 7.

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WELL HEAD ASSEMBLY

Filed Feb. 12, 1948 5 Sheets-Sheet 5

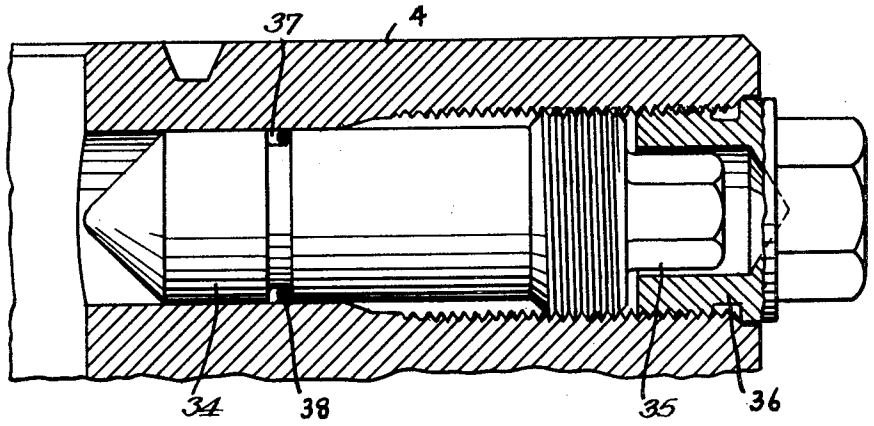


Fig. 10.

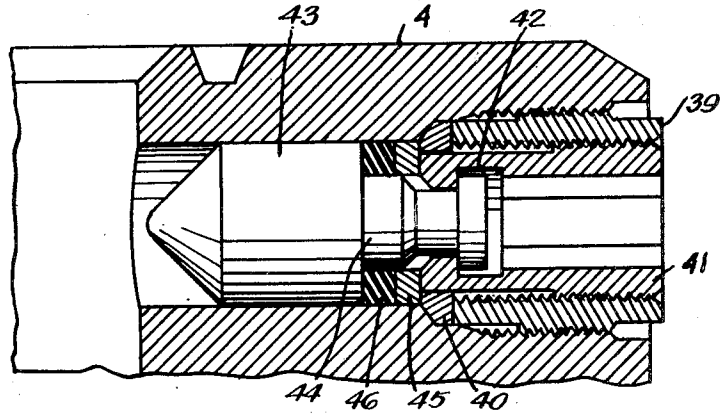


Fig. 11.

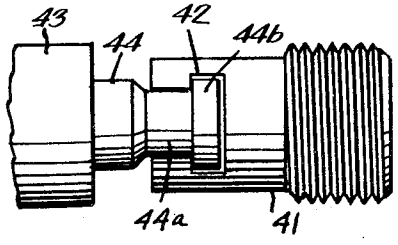


Fig. 12.

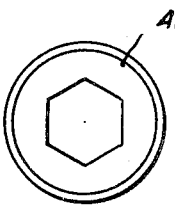


Fig. 13.

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UNITED STATES PATENT OFFICE

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WELLHEAD ASSEMBLY

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Application February 12, 1948, Serial No. 7,738

11 Claims. (Cl. 285—22)

1

This invention relates to a well head assembly.

An object of the invention is to provide in a well head a novel type of slip assembly which may be assembled around a pipe through the head and lowered into pipe supporting position with the pipe, or independently of the pipe, and which will form not only pipe supporting means but sealing means to seal between an inner pipe through the head and an outer casing.

The invention also embodies a slip bowl for containing pipe engaging slips with novel lock down screws mounted radially in the head and engageable with the bowl to secure it firmly in place and to apply pressure to the packing or releasable from the bowl to permit its removal from the assembly.

The invention also embodies a novel combination of slip bowl, formed of vertical sections and seal ring which forms a seal with the well head and with the pipe therein and also, in effect, forms a hinge between the bowl sections.

Other objects and advantages will be apparent from the following specification which is illustrated by the accompanying drawings, wherein:

Figure 1 is a side, elevation of the complete head shown partly in vertical section.

Figure 2 is a vertical, sectional view of the slip bowl and slips and the associated seal, or packing element.

Figure 3 is a cross-sectional view taken on the line 3—3 of Figure 2.

Figure 4 is a plan view thereof.

Figure 5 is a cross-sectional view taken on the line 5—5 of Figure 2 showing the slips and slip bowl in open position.

Figure 6 is a vertical, sectional view of the slip bowl taken on the line 6—6 of Figure 7.

Figure 7 is a transverse, sectional view taken on the line 7—7 of Figure 6.

Figure 8 is an enlarged, fragmentary, vertical, sectional view taken on the line 8—8 of Figure 7.

Figure 9 is an enlarged, fragmentary, vertical, sectional view taken on the line 9—9 of Figure 7.

Figure 10 is an enlarged, fragmentary, vertical, sectional view illustrating a form of lock down screw in retracted position.

Figure 11 is an enlarged, fragmentary, vertical, sectional view illustrating another type of lock down screw assembly shown in retracted position.

Figure 12 is a fragmentary, side elevation thereof, and

Figure 13 is an outer end view of the actuating screw.

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 a type of casing head which is attached to the upper end of a well casing 2 and which is provided with an internal annular seat 3, which preferably tapers downwardly and inwardly and said head may also be provided with an external annular flange 4 at its upper end.

2

One or more outlet pipes, as 5, may be connected into the head beneath the seat 3.

Embodied in the assembly there is a packing element, or seal ring, 6 which is open only at one side, as is illustrated in Figure 3, and which may be united, in any preferred manner, to the upper and lower sectional wear rings 7 and 8 formed of any suitable metal. These upper and lower rings 7 and 8 are each formed of a plurality separate arcuate sections and they are united to the seal ring 6 in any preferred manner. As shown they are united by dovetailed connections so that the said wear rings will open and close with the seal ring. The lower end of the lower wear ring 8 has a downwardly and inwardly tapering face 9 which conforms to the contour of, and which is adapted to seat on, the seat 3.

The seal ring 6 therefore not only provides an annular seal around the pipe 10 through the assembly but also forms a hingle which allows the assembly to open and be closed about the pipe.

Within the head 1 and adapted to rest on the sealing assembly above described there is a slip bowl 11. This bowl is formed of two semi-cylindrical sections which are seated on the corresponding sections of the wear ring 7 and which may be maintained in alignment with said wear ring sections by means of depending dowel pins 12, 12 which fit into corresponding sockets, as 13, in the wear ring 7.

The slip bowl sections may be permanently secured to the corresponding seal ring sections beneath if desired and the assembly may be secured around the pipe 10 by means of any selected type of latch, as 14, which may be pivoted to the free end of one section 11 and which may be engaged over a cross pin 15 carried by the free end of the other section 11.

The latch means above described should be located within an external transverse groove 16 of the slip bowl to protect the same from breakage.

Opposite the transverse groove 16 of the slip bowl there is a similar transverse groove 17 preferably parallel and aligned with the groove 16. In this groove there is an aligning key 18 which may be permanently secured to one of the sections 11, as by welding, and whose free end may

project across the joint into the other section 11 of the bowl so as to maintain said sections, at all times, in alignment.

This bowl is provided with an inside downwardly converging slip seat 19 which is overhung by the flange 20 at the upper end of the bowl and the bowl also has an external annular tapering face 21 extending all the way around it, at its upper end.

On the seat 19 there are the slips 22 whose outer sides taper to conform to the taper of, and to seat against, the inside seat 19 of the slip bowl and whose inner sides are toothed, or roughened, to readily engage the inner pipe 10. The upper ends of these slips extend up above the bowl and each slip has an external wide groove 23 to receive the flange 20 of the bowl. These slips may be provided with any suitable type of handles 24, at their upper ends by means of which they may be conveniently handled. As shown, these handles consist of ropes or cables whose ends are securely anchored to the upper ends of the respective slips.

The slips are maintained in transverse alignment, as more clearly shown in Figure 5, by means of keys 25 which are retained in external keyways 26 of the slips, one end of each key 25 being secured as by welding to one slip and the other end of the key projecting across the joint between the slips and into the adjacent keyway of the adjoining slip, as clearly illustrated in Figure 5.

In applying the slip bowl slip and seal to the pipe the assembly will be opened, as shown in Figure 5, and fitted around the pipe 10 above the casing head and latched therearound. While applying said assembly to the pipe the slips will be maintained in their upper outer position on the seat 19 by means of pins 27 whose outer ends have threaded heads which are screwed into the upper end of the slip bowl and whose inner ends project through the openings 28 of said bowl and into the sockets 29 of the respective slips but when the assembly is latched around the pipe these pins 27 are removed allowing the slips to move downwardly into contact with said pipe. The assembly as secured around the pipe is then released and it will move down by gravity into the casing head and will seat on the seat 3, as shown in Figure 1.

In many cases the well pipe, such as 10, is cemented in the well at its lower end and in making up the well head assembly this pipe is maintained under tension by means of the pipe elevators secured to the upper end thereof and suspended from the well derrick by wire line and when the bowl and slip assembly lands on the seat 3 the tension of the pipe 10 may be released so that the upper end of the pipe will move downwardly and the slips 22 will engage the pipe and thus cause the bowl to move downwardly placing the seal ring 6 under compression and thus forming fluidtight seals both with the pipe and with the casing head 1.

It will be evident that the seal ring 6 and its associated wear rings 7 and 8 provide a sealing assembly or unit which may be readily engaged around the well pipe. Each wear ring is formed of arcuate sections which are entirely separate from each other and are secured together by the seal ring which is split at only one radical point. Although each wear ring is illustrated as consisting of two sections, said ring could be made of three or more, with all sections thereof attached to the elastic seal ring. The slip bowl

11 is attached to the upper wear ring 7 by the dowel pins 12 which have a tight fit within the sockets 13 and thus the elastic ring functions as the hinge for the complete device. This eliminates the necessity of providing a metallic hinge pin for the slip bowl sections and greatly simplifies the construction. Because the slip bowl has considerable length it is desirable that the bowl sections be provided with the aligning keys 25 and co-acting keyways which maintain alignment of the bowl sections in a plane normal to the axis of the bowl; the keys 25 do not function to connect the bowl sections but are merely aligning members so that the hinge between the sections is formed solely by the seal ring 6. It is apparent that when the sealing assembly is in position within the head, the weight of the well pipe 10 is imposed upon the assembly through the slips 22 and bowl to expand the seal ring 6 of said assembly into expanded sealing position.

The type of assembly herein described may be employed in carrying out the method disclosed in the application of Arthur J. Penick for Well Head Assembly filed January 19, 1946, under Serial No. 642,354, now Patent No. 2,481,035.

As hereinabove stated the upper end of the slip bowl has an external annular tapering face 21 and mounted radially in the flange 4 of the casing head lock down means have been provided which may be screwed radially inwardly to engage said face 21 to lock the assembly in the head against upward movement.

As illustrated in Figure 1 there are the externally threaded bushings 29 screwed into the flange 4 and mounted axially in these bushings and extending inwardly are the stems 30 whose inner ends are formed with enlarged heads 31 whose inner ends are tapered to engage the tapering face 21. Around each stem 30 and between the inner end of the bushing 29 and the head 31 there is a packing 32 to form a fluidtight joint. The outer end of the stem 30 is reduced and extends through the outer end of the bushing 29 and is maintained assembled therewith by means of a nut 33 screwed onto the outer end of said stem and abutting the outer end of the bushing.

The outer end of the bushing is polygonal to receive a socket wrench whereby the lock down assembly may be screwed inwardly with the tapering inner end of the head 31 into contact with the tapering face 21 or screwed outwardly into released position. This lock down assembly just described, it will be noted, is housed completely within the flange 4 so that it will not be liable to be broken or distorted.

In Figure 10 a form of lock down means is shown which comprises a lock down bolt 34 whose inner end is tapered to conform to the taper of the face 21 and whose outer end is enlarged and threaded into the flange 4. Its outer end 35 is polygonal in form to receive a wrench to screw it inwardly or outwardly and its outer end is protected by a suitable cap 36 which is screwed into the flange 4. This lock down bolt 34 has an external annular groove 37 to receive an O-ring 38 to form a fluidtight seal around it.

Referring now to Figures 11 to 13, inclusive, there is screwed into the flange 4 a tubular bushing 39 whose inner end abuts a retaining ring 40 which is thereby clamped in place in the flange and screwed into the bushing 39 with its inner end extending through the retaining ring 40 there is a tubular retractor 41 whose inner end is provided with a T-slot 42. In this form there is a head 43 whose inner end is tapering to en-

gage the tapering face 21 and this head is provided with a stem 44 whose outer end is reduced forming a neck 44a with an annular flange 44b on its outer end. This neck and flange fit laterally into the T-slot 42 so as to form a connection between the retractor and head 43.

The inner end of the retractor 41 abuts a clamp ring 45 around the stem 44 and between said clamp ring and the opposing end of the head 43 there is a seal ring 46 which forms a seal between the lock down means and the flange 4. A wrench may be inserted into the socket of the retractor and it may be screwed inwardly to force the tapering face of the head 43 into engagement with the annular face 21 or it may be screwed outwardly to withdraw said head into the flange 4 to permit removal of the assembly within the head 1.

It is to be noted that the lock down means, in each form, are spaced apart around the flange 4 and are housed completely within said flange for protection. The various forms of lock down means are of such construction that they may be used interchangeably.

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. In a well head assembly, a sectional slip bowl, an annular split sealing assembly associated with the bowl and attached to the sections of said bowl, said sealing assembly including a seal ring formed of resilient material and open at one side and forming, in effect, a hinge on which the sections of the bowl and sealing assembly may be opened and closed.

2. In a well head assembly, a combined section slip bowl and annular, sealing assembly including a seal ring open at one side, said seal ring being attached to the sections of the sealing assembly and to the slip bowl and forming the sole hinge on which the bowl and sealing assembly may be opened and closed, said sealing assembly being detachable from the bowl.

3. In a well head assembly, a combined sectional slip bowl and annular, sectional sealing assembly including a seal ring open at one side, said seal ring being attached to the sections of the sealing assembly and to the bowl and forming the sole hinge on which the bowl and sealing assembly may be opened and closed, the sections of the bowl, on the hinge side, having a transverse keyway and a key in said keyway secured to one of the bowl sections and projecting across the hinge into the keyway in the other section to maintain the bowl sections aligned.

4. In a well head assembly, a sectional slip bowl having its sections unconnected with each other and also having an inside downwardly tapering seat, an annular sealing assembly attached to the sections of the bowl and including a seal ring formed of resilient material and open at one side and forming the sole hinge on which the bowl sections and sealing assembly may be opened and closed and pipe engaging slips on the seat.

5. In a well head assembly, a combined sectional slip bowl having its sections unconnected with each other, an annular, sectional sealing assembly having unconnected arcuate segments and including a continuous seal ring, open at one side, said seal ring being attached to sections of the slip bowl and forming the sole hinge on which the bowl and sealing assembly may be opened and closed, said bowl having an inside downwardly tapering inside seat, wedge shaped pipe engaging slips mounted on said seat and latch means for securing the slip bowl and annular sealing assembly around a pipe through said assembly.

6. In a well head unit adapted to be wrapped around a pipe and installed in a well head for the purpose of effecting a seal of the annular space between said well head and said pipe through the head; a resilient annular sealing element, a metallic annular ring composed of a plurality of arcuate sections disposed on each side of said element and which serve to support and confine said resilient element, means for attaching said sections to the resilient sealing element, transverse aligning means rotatably maintaining said arcuate sections in a plane normal to the center lines of said arcuate sections, said aligning means forming in combination with said resilient means the sole hinge for said sections.

7. In a well head, a means for suspending an inner pipe in the head, a compressible seal ring around the pipe positioned, relative to the suspending means so as to be compressed around the pipe by the weight of the suspended pipe, said sealing means being composed of resilient material and open on one side and the supporting means being composed of a plurality of arcuate sections, keying means on one section and a transverse keyway in an adjacent section to receive said keying means, the resilient sealing means forming the sole hinge for the arcuate sections with the keying means providing aligning means to maintain alignment of the sections during swinging movement.

8. A well head sealing unit including, an annular packing element having a radial split therein, a pair of wear rings above and below said element, each wear ring being composed of arcuate sections which are unconnected with each other but attached to said element, one of the joints between the sections of each wear ring being aligned with the radial split in the packing element, whereby the packing element functions as the hinge for opening movement of the sections, and a segmental slip supporting bowl mounted on the upper wear ring and having its segments unattached to each other, whereby said packing element also functions as a hinge for the segments of said bowl.

9. A well head sealing unit including, an annular packing element having a radial split therein, a pair of wear rings above and below said element, each wear ring being composed of arcuate sections which are unconnected with each other but attached to said element, one of the joints between the sections of each wear ring being aligned with the radial split in the packing element, whereby the packing element functions as the hinge for opening movement of the sections, a segmental slip supporting bowl mounted on the upper wear ring and having its segments unattached to each other, whereby said packing element also functions as a hinge for the segments of said bowl, and slip members supported with the bowl and adapted to grip a well pipe around which the unit is arranged to be engaged.

10. A wall head sealing unit including, an annular packing element having a radial split therein, a pair of wear rings above and below said element, each wear ring being composed of arcuate sections which are unconnected with each other but attached to said element, one of the joints between the sections of each wear ring being aligned with the radial split in the packing

element, whereby the packing element functions as the hinge for opening movement of the sections, a slip supporting bowl formed of arcuate sections which are unconnected with each other, means for attaching said bowl sections to the sections of the upper wear ring, whereby the hinge between the bowl sections is formed by the packing element, and co-acting aligning means between the joints of adjacent sections of the slip bowl for maintaining the sections in alignment in a plane normal to the axis of the bowl.

11. A well head sealing unit as set forth in claim 10, together with sectional gripping slips in said bowl, and removable means for maintaining the slips in a non-gripping position within the bowl to retain said slips within the bowl until the unit is engaged around a well pipe.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,650,074	Kammerdiner	Nov. 22, 1927
1,836,565	Wigle	Dec. 15, 1931
2,480,955	Penick	Sept. 6, 1949