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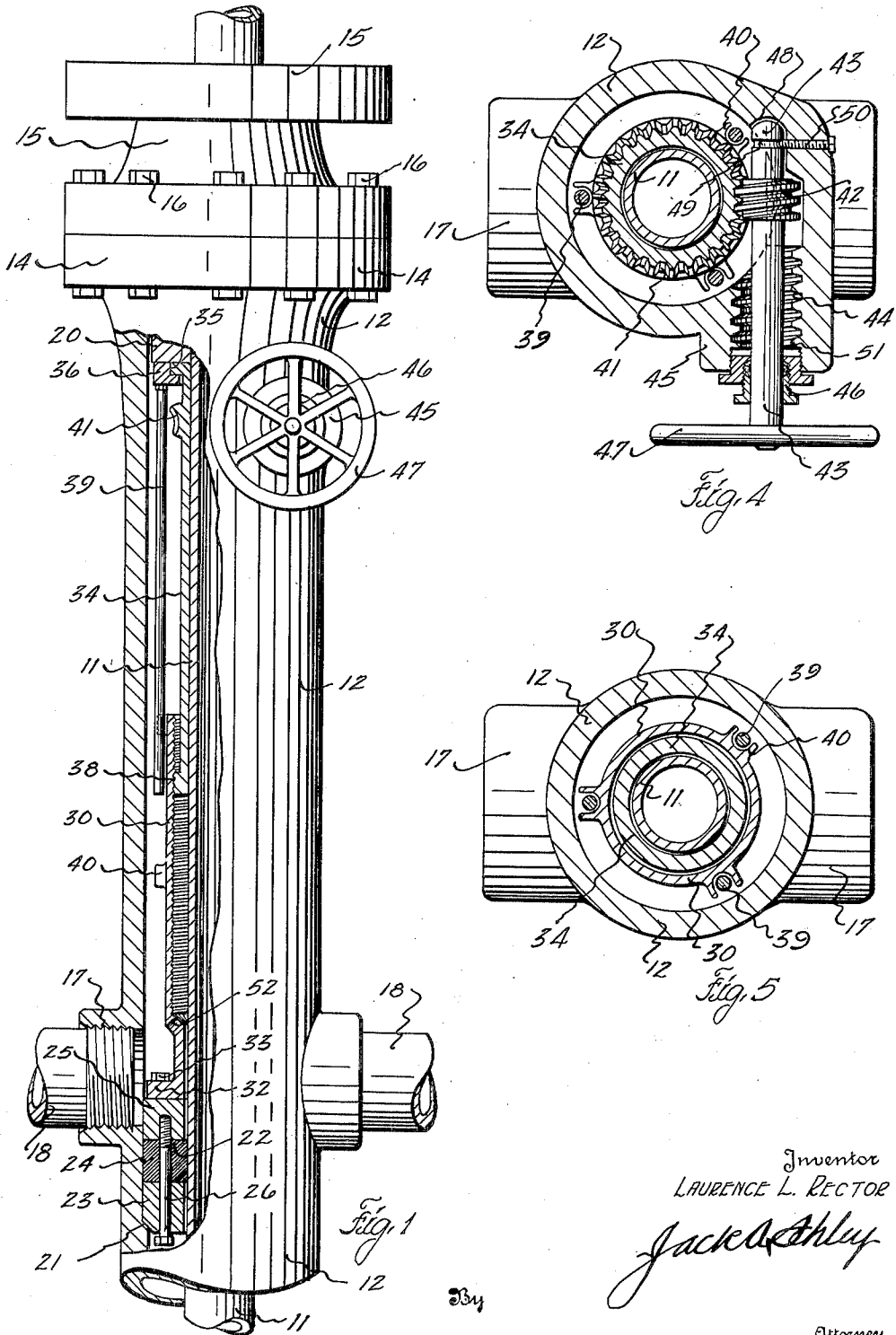
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2,139,207

PACKING DEVICE

Filed Nov. 30, 1936

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

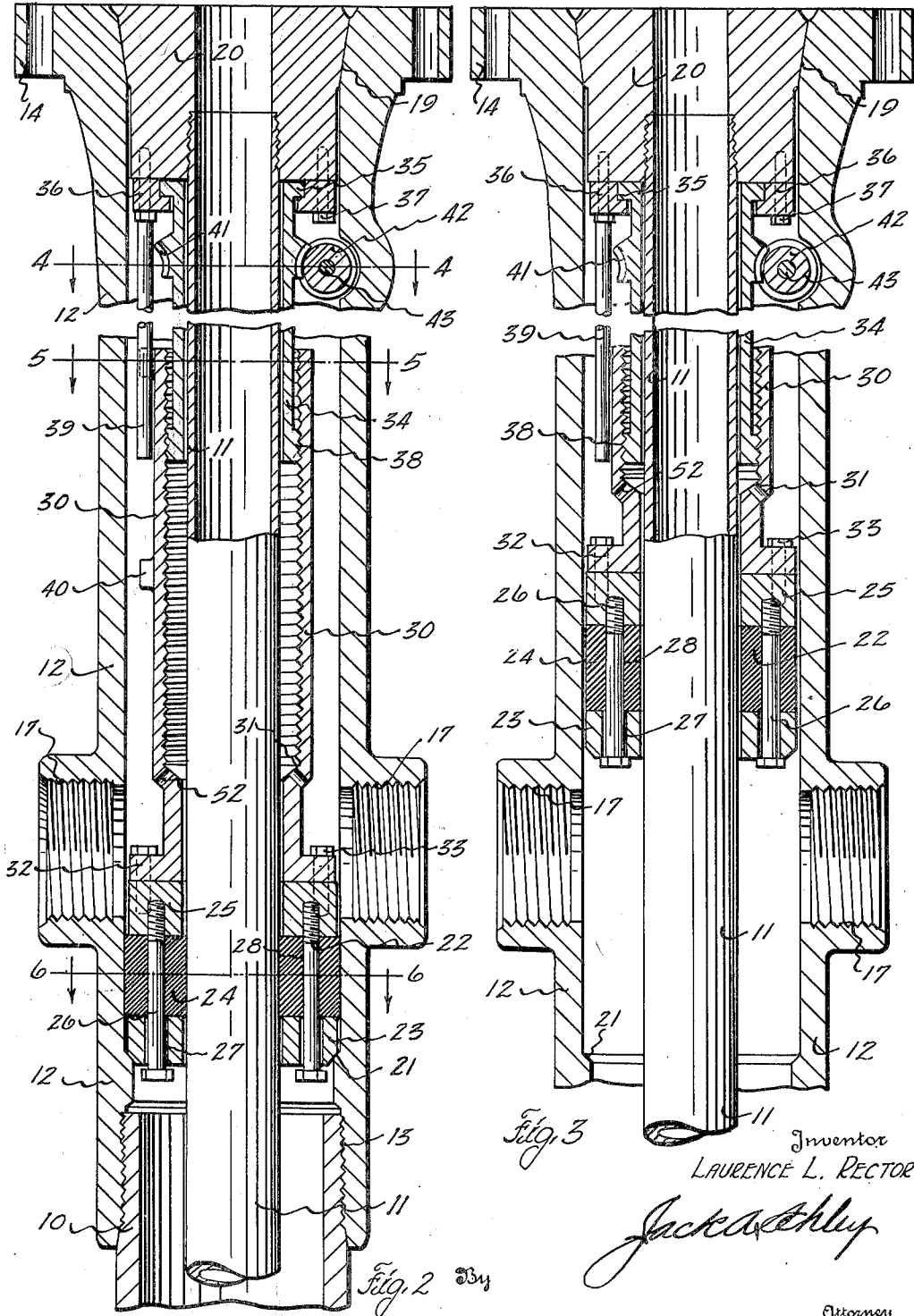


Fig. 3

Fig. 2

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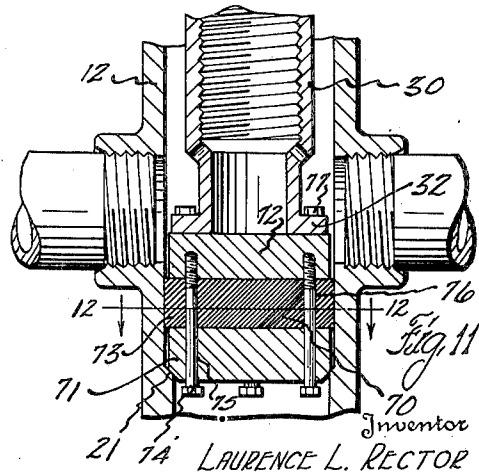
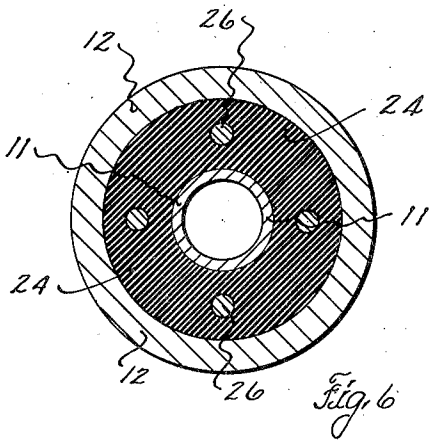
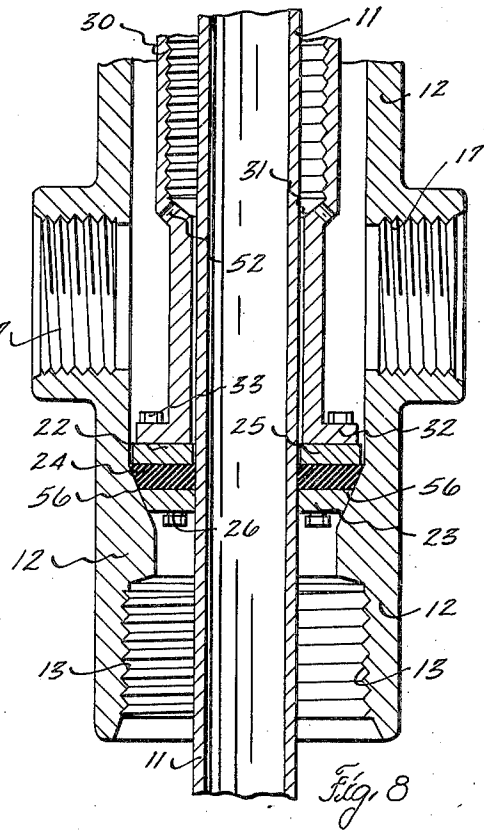
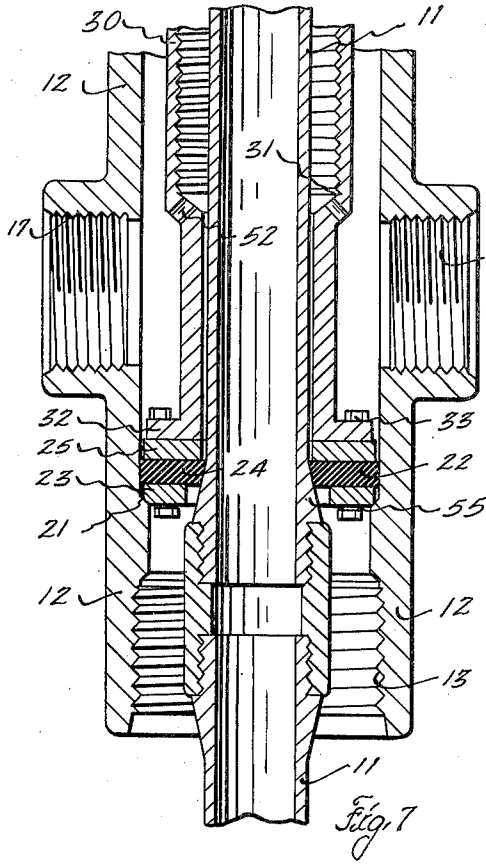
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PACKING DEVICE

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4 Sheets-Sheet 3



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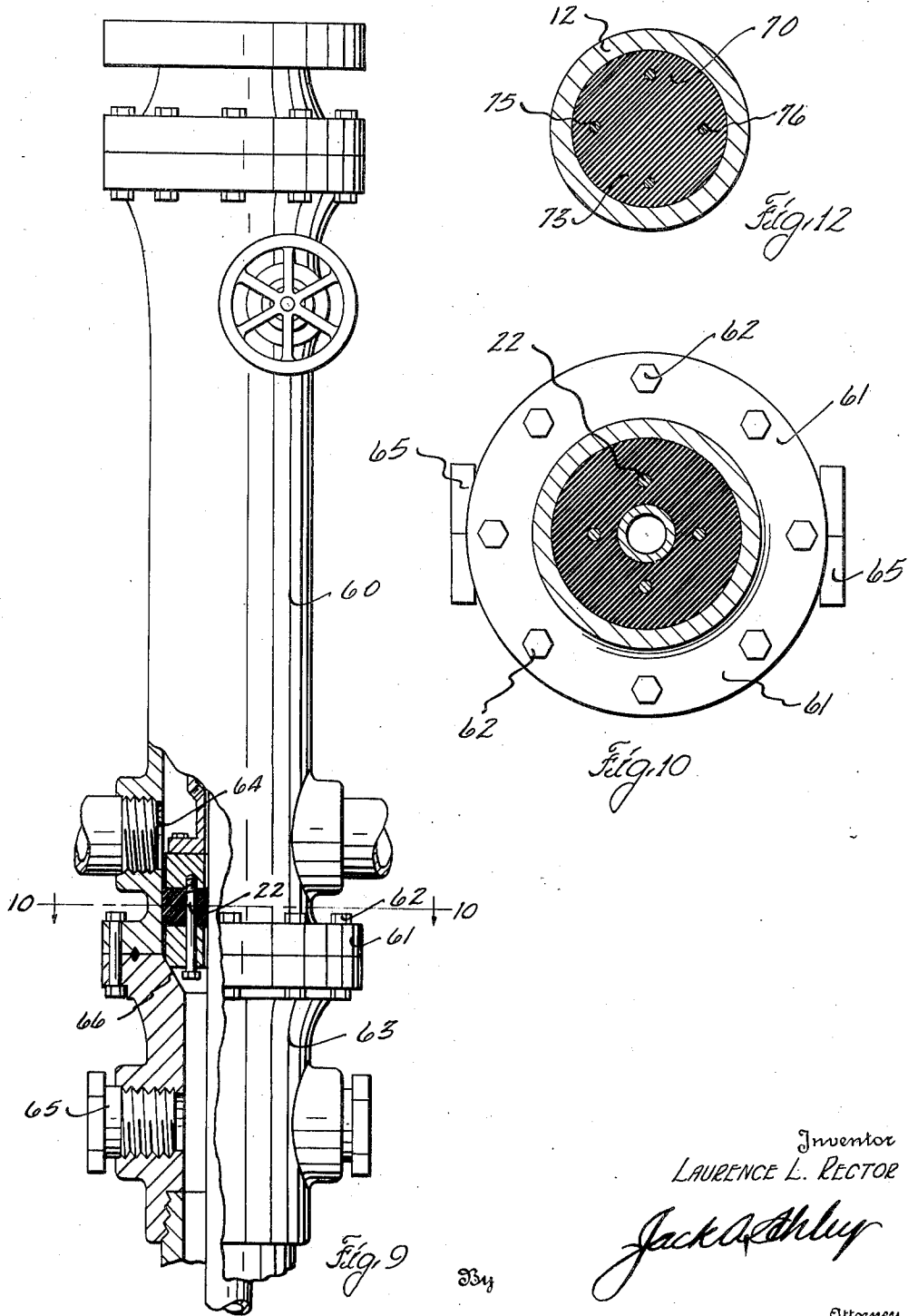
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# UNITED STATES PATENT OFFICE

2,139,207

## PACKING DEVICE

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Application November 30, 1936, Serial No. 113,281

14 Claims. (Cl. 166—15)

This invention relates to new and useful improvements in packing devices.

In producing oil and gas wells in which well tubing is used as an eduction line, it is common practice to employ a tubing head from which the tubing is suspended. The usual head has suitable means for packing off the annular space between the tubing and the well casing to form a seal therebetween. So long as the tubing remains in the one position the tubing head provides an effective means for holding the pressures.

However, after the well is in production, it sometimes becomes necessary to manipulate the tubing, that is, raise, lower, or occasionally remove from and return the same within the well casing. In order to manipulate the tubing while holding under control the pressure of the fluid between the tubing and casing, it is necessary to remove the upper fittings of the tubing head and assemble a blowout preventer, or other safety device, thereabove, whereby the tubing may be manipulated through such safety devices while the pressure is held under control. When the upper fittings of the head are removed, the packing of the tubing head is also removed and therefore, after removal of such packing and prior to assembly of the safety device, the well is wide open and the pressure uncontrolled.

Various kinds of apparatus, such as transversely operating rams, have been employed to hold the pressure under control during assembly of the blowout preventer or other safety device. Such apparatus has proven most expensive and hazardous, and cannot be repacked or replaced under pressure, which is a most serious disadvantage.

One object of this invention is to provide an improved device for sealing off the annular space between the well tubing and the well casing.

An important object of the invention is to provide an improved packing device adapted for use with a tubing head for holding under control the well pressure while the upper fittings of the tubing head are disassembled and suitable blowout equipment mounted thereon.

Another object of the invention is to provide an improved packing device which is constructed to provide a seal below the tubing support and the usual radial ports of a tubing head, whereby the well pressure is held under control at such point, which permits any repairs or disassembly of equipment thereabove without any loss of well pressure.

A further object of the invention is to provide an improved packing device which is operable from the exterior and which is so constructed that

the packing or sealing means may be run in or removed from its operating position around the well tubing under well pressure and without loss of such pressure, whereby said means may be readily removed for repairs or replacement.

Still another object of the invention is to provide an improved packing device which is mounted to seal off the annular space between the well casing and tubing and which is so arranged that its mounting or operation does not interfere in any way with the normal operation of the well equipment.

A still further object of the invention is to provide an improved packing device which may be attached to a tubing head of the usual type and in combination therewith form an elongate head within which the movable sealing means of said device is operable.

A further object of the invention is to provide an improved packing device which is so constructed that it may be used as a plug to close the entire well casing or other fluid passage.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Figure 1 is a view, partly in elevation and partly in section, of a tubing head seal constructed in accordance with the invention,

Figure 2 is an enlarged, transverse, vertical, sectional view of the device in the sealing position,

Figure 3 is a similar view showing the sealing means retracted,

Figure 4 is a horizontal, cross-sectional view taken on the line 4—4 of Figure 2,

Figure 5 is a horizontal, cross-sectional view taken on the line 5—5 of Figure 2,

Figure 6 is a horizontal, cross-sectional view taken on the line 6—6 of Figure 2,

Figure 7 is an enlarged, transverse, vertical, sectional view of a portion of the device showing another form of packing element,

Figure 8 is a similar view showing a third form of packing element,

Figure 9 is a view, partly in elevation and partly in section of a form of the invention adapted for use in conjunction with a conventional tubing head,

Figure 10 is a horizontal, cross-sectional view, taken on the line 10—10 of Figure 9,

Figure 11 is a transverse, vertical sectional view of a portion of the device showing another form of packing element for plugging the wall casing, and

5 Figure 12 is a horizontal, cross-sectional view taken on the line 12—12 of Figure 11.

In the drawings, the numeral 10 designates a well casing having the usual well tubing 11 extending therein. An elongate tubing head housing or body 12 is provided with internal screw threads 13 at its lower end, whereby it may be mounted on the well casing or other support. The upper end of the body 12 is flared outwardly and formed with an external annular flange 14, 15 whereby a suitable connector flange 15 or other member may be connected thereto by bolts 16 or other fastening means. An internal annular bowl or seat 19 is provided in the upper end of the body and a boll weevil or other support 20 for the tubing is seated therein, whereby the tubing 11 is suspended from the upper end of the body. The usual radial ports 17 for receiving pipes 18, or other conductors, are provided near the lower end of the body and are spaced above the internal screw threads 13. The above parts form an ordinary tubing suspension assembly, except that the body 12 is made longer between the ports 17 and the upper end thereof than is customary in the conventional tubing head

30 An internal annular ground seat 21 is provided in the lower end of the elongate body above the screw threads 13 and below the ports 17. An annular packing element 22 surrounds the tubing 11 within the bore of the body 12. This element 35 includes a metallic supporting ring 23 having its lower outer edge bevelled to engage the seat 21 in the body 12. An upper ring 25 is mounted above the ring 23 and an elastic packing ring 24 is confined between these rings. Bolts 26 extend through openings 27 in the supporting ring 23 and openings 28 in the packing ring and are screwthreaded into the upper ring 25. The bolts are slidable through the openings in the supporting ring 23 but are closely engaged in the openings in the packing ring, whereby fluid under pressure cannot leak therethrough. It is noted that the packing element is slidable vertically within the body and the packing ring 24 is normally out of engagement with the walls of said body and the tubing. It will be seen that, when the supporting ring is engaging the seat 21, a downward pressure on the upper ring 25 will distort the packing ring 24 into sealing engagement with the bore of the body and the tubing.

55 For moving the packing element within the body and exerting a sealing pressure thereon, any suitable means may be used, but I have shown an elongate cylindrical sleeve 30 surrounding the tubing above the packing element 22. The sleeve 60 is reduced at its lower end to closely surround the tubing 11 and an offset or shoulder 31 is formed between the reduced portion and the remainder of the sleeve. An external annular flange 32 is provided at the extreme lower end of the sleeve and this flange is secured to the upper surface of the upper ring 25 of the packing element by bolts 33, or any other suitable means. The sleeve above the offset is internally screw threaded and extends upwardly within the body 70 12, terminating at a point substantially mid-height of the body. A rotatable actuating sleeve 34 is provided with an external annular flange 35 at its upper end and this flange is confined within a flanged ring 36 secured by bolts 37 to the under surface of the tubing support 20,

whereby the actuating sleeve is rotatably suspended from said support. This sleeve closely surrounds the well tubing and its lower end telescopes the upper end of the sleeve 30. The enlarged lower end 38 of the actuating sleeve is provided with screw threads, preferably coarse, 5 which engage similar screw threads on the bore of the sleeve 30. Elongate rods 39 have their upper ends secured to the underside of the flanged ring 36 and extend vertically within the bore of the body 12 in close proximity to the outer periphery of the elongate sleeve 30. Vertically aligned guide lugs 40 are provided on the outer periphery of the sleeve 30 and slidably engage the rods 39, whereby during vertical movement of the sleeve said lugs, by their engagement with the vertical rods, prevent rotation of said sleeve. 15 It will be seen, therefore, that rotation of the actuating sleeve 34 will cause vertical movement of the sleeve due to the screw jack action of their 20 threaded engagement, and such actuation of said sleeve will cause the lower ring to engage the seat 21. Further downward movement of the sleeve 30 will exert a pressure upon the upper ring 25 to cause distortion of the packing ring 24 25 into sealing engagement with the bore of the body and the tubing.

For rotating the actuating sleeve 34, an integral external gear ring 41 is provided near the upper end of said sleeve. A worm gear 42 is adapted to mesh with said gear ring and this worm gear is carried by a shaft 43 extending through an opening 44 provided in the wall of the body 12. A collar 45 surrounds the outer end of the opening 44 and the shaft of the worm gear extends there- 35 through. A stuffing box 46 is mounted in the outer end of the collar 45 and surrounds the shaft 43 to prevent fluid pressure leakage there-through. A suitable handwheel 47 is secured to the outer end of the shaft, whereby the same may 40 be rotated.

The inner end of the shaft 43 is rounded and adapted to engage in a recess 48 provided in alignment therewith in the inner wall of the body 12 whereby said recess acts as a thrust bearing 45 when the shaft is rotated to actuate the sleeve 34. It will be seen that rotation of the worm gear in one direction will move the sealing element into sealing position, while rotation in the opposite direction will move the same in an opposite direction. To prevent disengagement of the worm gear from the gear ring while said gear is being rotated to move the sealing element from its sealing position, an annular groove 49 is provided near the inner end of the shaft 43 and 55 this groove is adapted to receive the inner end of a screw or bolt 50 which is screw threaded in the wall of the body 12 in radial alignment with said shaft. It is obvious that when the inner end of the screw is engaged in the groove the shaft may 60 not be retracted.

The bores of the collar 45 and the opening 44 in the body are provided with internal threads 51 adapted to receive the worm gear. It is noted that the worm gear is normally out of engagement with these threads (Figure 4), being held 65 so by the screw 50. By removing the screw and rotating the worm gear, said gear will be moved toward the opening and into engagement with the threads 51, said threads being so positioned 70 that the worm gear will engage them before being disengaged from the gear ring 41. It is noted that this arrangement affords a positive means for retracting the worm gear and shaft into the collar 45. It is further noted that the bores of 75

the collar and opening are of such length that when the worm gear has been screwed outwardly therein into engagement with the stuffing box, the inner end of the shaft 43 lies in a plane outside the bore of the body 12, whereby the well tubing and the packing element, or other tools ordinarily run through the tubing head, may be removed or inserted therethrough without interference from said shaft.

10 In normal operation and while the well is producing, the sealing element 22 is in the position shown in Figure 3, but should an occasion arise requiring packing off the annular space between the well casing and tubing, said sealing element 15 will be lowered to the sealing position, shown in Figure 2. To move the packing element 22 into a sealing position, the handwheel 47 is rotated to rotate the form 42. Such rotation of the worm will cause rotation of the actuating sleeve 20 34, and since the sleeve 30 is prevented from rotation by the rods 39 said sleeve will be moved downwardly within the body 12 until the supporting ring of the sealing element is in engagement with the annular seat 21. Further downward movement of the sleeve will thereupon distort the packing ring 24 into sealing engagement with the wall of the body and the tubing 11, thus sealing off the annular space between the casing and tubing below the tubing support and the 30 ports 17 in the body 12, whereby the well pressure is held under control below said ports. Thus, leaks in the pipes or other conductors leading from said ports may be repaired or other changes made.

35 When the seal has been formed as described, the upper fittings of the tubing head may be removed without danger or losing pressure. After removal of said fittings, blowout preventers or other safety devices may be mounted on the 40 upper end of the head in the usual manner, whereupon the seal formed by the packing element 22 may be safely broken. This is accomplished by rotating the handwheel in the opposite direction reversing the procedure hereinbefore 45 described, moving the sealing element to the position shown in Figure 3. As the sleeve 30 is moved upwardly, any liquid or other extraneous matter in the space between the enlarged upper portion of said sleeve and the well tubing will be evacuated therefrom through drain openings 52 50 provided in the offset or shoulder 31 of said sleeve.

After the seal has been broken, the screw or bolt 50 is retracted from the groove 49 in the 55 shaft and the worm and shaft rotated to retract the same into the collar 45, out of the bore of the body. This permits removal of the tubing support and the packing element, with the tubing, from the tubing head under pressure in the 60 usual manner through the blowout preventers or other safety devices mounted on the tubing head. Thus, it will be seen that the packing element may be repacked or replaced under pressure which has heretofore been impossible or impractical. 65

After the tubing has been manipulated as desired, the packing device is reinserted into the tubing head, the worm gear moved into operating position and the packing element moved 70 into sealing position. When the seal has been formed, as has already been described, the blowout preventers, or other devices, may be disassembled from the tubing head and the usual upper fittings reinstalled. At this time the seal 75 may be broken and the element moved to the

position shown in Figure 3 and held ready for future use.

In Figure 7, the tubing 11 is shown having an outwardly inclined bevel 55 at its ends. As shown, this bevel is located in the same horizontal plane with the seat 21 in the tubing head body being suspended in such a position from the usual tubing support as has already been described. It will be obvious that, as the sealing element is moved into sealing position, the 10 bevel on the tubing acts to urge the packing ring into a more certain engagement with the wall of the body 12. In this case a supporting ring having an enlarged inner diameter is used. The bevel on the tubing may be formed by welding, 15 machining or any suitable means, or the usual upset tubing now in common use which has a similarly shaped end may be used if desired.

In Figure 8 an elongate tapered seat 56 is shown formed within the body 12 below the ports 20 17. This seat serves both to urge the packing ring into a more definite engagement with the tubing and to form a seat for the supporting ring.

A modified form of the invention is shown in Figure 9, in which an elongate tubular adapter 25 body 60 is formed with an external annular flange 61 at its lower end, whereby it may be secured by bolts 62 to a tubing head 63 of the conventional type. Radial ports or openings 64 are provided in the adapter body and are spaced 30 from its lower end. These ports replace the ports in the tubing head 63 which are closed with plugs 65. It will be seen that the bowl 66 in the upper end of the conventional head 63 may be used as a seat for the sealing element 22. The internal 35 diameter of the adapter body is, therefore, made slightly larger than the bore of the tubing head. All other details remain the same as have already been described. It is understood that, should a tubing head be used having screw 40 threads at its upper end instead of the flange shown, the lower end of the adapter body may be screw threaded to be connected thereto. This form of the invention may be readily applied to the usual tubing head now in use without the 45 necessity of replacing the same with the head first described.

It will be seen that this invention provides a sealing device for holding under control the well fluid pressure in the annular space between the 50 tubing and casing, which seal is positive and safe in action, and which may be removed under pressure for replacing worn parts.

While the means for operating the packing element has been shown as manually operated, it is 55 noted that a suitable hydraulic pressure operated means may be used, if desired, without departing from the spirit of the invention.

In some instances it becomes necessary or desirable to plug or close the entire well fluid passage with the tubing removed. In such instances a packing element 70, as shown in Figures 11 and 12, is provided. The element includes a circular supporting plate or disk 71 having its lower 60 outer edge beveled to engage the seat 21 in the body 12. An upper disk 72 is mounted above the disk 71 and a solid packing disk 73 is confined between these upper and lower disks. Bolts 74 extend through openings 75 in the supporting disk 71 and openings 76 in the packing disk and 70 are screw threaded in the upper disk in a similar manner to those of the elements hereinbefore described. The upper disk 72 is secured to the lower flanged end of the sleeve 30 by bolts 77 or other suitable means, and the packing element is 75

operable thereby in the manner already described.

It will be seen that the provision of a solid packing element adapted to be distorted into sealing position below the radial ports in the tubing head permits plugging or completely closing the fluid passage through the well casing and the body 12, whereby the well pressures are held under control at such point with the tubing removed.

What I claim and desire to secure by Letters Patent, is:

1. A packing device including, a tubular body having radial ports therein and adapted to be mounted on a well casing, said body having a bowl formed in its upper end for receiving a tubing support for suspending a well tubing whereby said tubing depends axially within the body, a vertically movable packing element within the body and surrounding the tubing below said support, a seat in the body below the ports therein adapted to be engaged by the packing element, means normally within the bore of the body for moving the packing element into engagement with the seat to form a seal, and means for retracting said means from within the bore of the body.

2. A packing device including, a tubular body having radial ports therein and adapted to be mounted on a well casing, said body having a bowl formed in its upper end for receiving a tubing support for suspending a well tubing whereby said tubing depends axially within the body, a packing assembly within the body including a vertically movable packing element surrounding the tubing below said support, a seat in the body below the ports therein adapted to be engaged by the packing element, operating means normally engaging the packing assembly for moving the packing element into engagement with the seat and distorting said element into sealing position, and means for retracting the operating means from engagement with the packing assembly to permit removal of said packing assembly from within the body.

3. A packing device including, a tubular body having radial ports therein and adapted to be mounted on a well casing, said body having a bowl formed in its upper end for receiving a tubing support for suspending a well tubing whereby said tubing depends therefrom axially within the body, a vertically movable packing element within the body and surrounding the tubing below said support, a seat in the body below the ports therein adapted to be engaged by the packing element, telescoping sleeves suspended from the tubing support and connected with the packing element, exteriorly operable means engaging the sleeves for actuating the same to move the packing element into engagement with the seat and to distort said element into sealing position, and means for retracting the actuating means from engagement with the telescoping sleeves to permit removal of the sleeves and packing element from within the body.

4. The combination with a tubing head of a packing device including, a tubular adapter body having radial ports therein to supplant the usual ports in the tubing head, said body being adapted to be mounted on the upper end of the tubing head, means at the upper end of the body for immovably suspending a well tubing extending continuously through the body, a vertically movable packing element within the body for sur-

rounding the tubing below said suspending means, the bowl in the upper end of the tubing head having a seat arranged to be engaged by the packing element, operating means normally engaging a packing assembly for moving the packing element into engagement with the seat and body for distorting said element into sealing position with the body, and means for retracting the operating means from engagement with the packing assembly to permit removal of said assembly from within the body.

5. A packing device including, a tubular body having radial ports therein and adapted to be mounted on a well casing, means at the upper end of the body for suspending a well tubing whereby said tubing depends axially within the body, a vertically movable packing element within the body and surrounding the tubing below said suspending means, a seat in the body below the ports therein adapted to be engaged by the packing element, a beveled shoulder on the tubing in the same horizontal plane with said seat, and means for moving the packing element into engagement with the seat and beveled shoulder, whereby due to said bevel the packing element is urged into a positive sealing engagement with the body and tubing.

6. A packing device including, a tubular member having a seat at its upper end and a seat at its lower end, a packing support having its upper end engaged in the upper seat of the member whereby the support is suspended in the tubular member so that it may be removed therefrom, a packing element vertically movable on the support and having a sealing medium for engaging the lower seat of the member to seal the device, and means carried by the support for moving the packing element to seal and unseal the device.

7. A packing device, including, a tubular member having a seat at its upper end and a seat at its lower end, a packing support having its upper end engaged in the upper seat of the member whereby the support is suspended in the tubular member so that it may be removed therefrom, a packing element vertically movable on the support and having a sealing medium for engaging the lower seat of the member to seal the device, means carried by the support for moving the packing element to seal and unseal the device, and means on the packing support for suspending a well tubing.

8. A packing device including, a tubular member having a seat at its upper end and a seat at its lower end, a packing support having its upper end engaged in the upper seat of the member whereby the support is suspended in the tubular member so that it may be removed therefrom, a packing element vertically movable on the support and having a sealing medium for engaging the lower seat of the member to seal the device, means carried by the support for moving the packing element to seal and unseal the device, and operating means extending exteriorly of the tubular member and movable into and out of engagement with the moving means.

9. A packing device including, a vertical tubular body having outlets, a valve seat in the body below the outlets, a rotatable tubular support in the body above the outlets of such size as to surround the well tubing and having external screw threads, means for rotatably suspending the support in the body, a tubular packing element receiving the support and having internal screw threads engaged by the screw threads of the sup-



port, a packing carried by the packing element for engaging the seat to seal the body, means for holding the packing element against rotation, and means for rotating the support having operating means exterior of the body.

10. A packing device including, a tubular member having a seat at its upper end and a seat at its lower end, a packing support having its upper end engaged in the upper seat of the member whereby the support is suspended in the tubular member so that it may be removed therefrom, a packing element vertically movable on the support and having a sealing medium for engaging the lower seat of the member to seal the device, means carried by the support for moving the packing element to seal and unseal the device, and a well tubing extending through the packing element and having an inclined portion, the sealing medium of the packing element having an inclined portion for engaging and sealing around the inclined portion of the tubing.

11. A packing device including, a tubular member having a seat at its upper end and a seat at its lower end, a packing support having its upper end engaged in the upper seat of the member whereby the support is suspended in the tubular member so that it may be removed therefrom, a packing element vertically movable on the support and having an imperforate portion for engaging the lower seat of the tubular member to plug the device, a sealing medium carried by the packing element for sealing the tubular member, and means carried by the support for moving the packing element to plug and unplug the device.

12. A packing device including, an exterior upright tubular body having an open bore for housing a continuous tubing extending through it, a seat at the lower end of the bore, means for immovably mounting said body, an elongate tubular supporting member vertically movable within the bore of the body when the body is stationary, a

packing element carried on the lower end of said member and arranged to seat at the lower end of the bore of the body, and means having an operating member extending through the wall of the body for moving said supporting member within the bore of said body to seat said packing element and shut off upward flow into and through the bore of said body.

13. A packing device including, a tubular body having an open bore extending therethrough, means at the upper end of the body for suspending a tubing in the bore of said body, whereby said tubing depends axially through the bore of said body, an elongate tubular member movable vertically in the bore of the body, a packing element carried by the member for engaging and packing off the bore of the body and around the tubing, and means for vertically moving said member to engage said packing with the wall of the bore of said body, said body having a lateral outlet, said movable member being freely movable in the bore of said body above and below said outlet to shut off the same from a flow below said outlet.

14. A packing device including, an exterior upright tubular body having an open bore for housing a continuous tubing extending through it, a seat at the lower end of the bore, means for immovably mounting said body, an elongate tubular supporting member vertically movable within the bore of the body when the body is stationary, a packing element carried on the lower end of said member and arranged to seat at the lower end of the bore of the body, means having an operating member extending through the wall of the body imparting movement to the supporting member, and a screw threaded connection between said means and the supporting member.

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