April 9, 1935. A. J. PENICK ET AL 1,997,431

PACK-OFF TOOL

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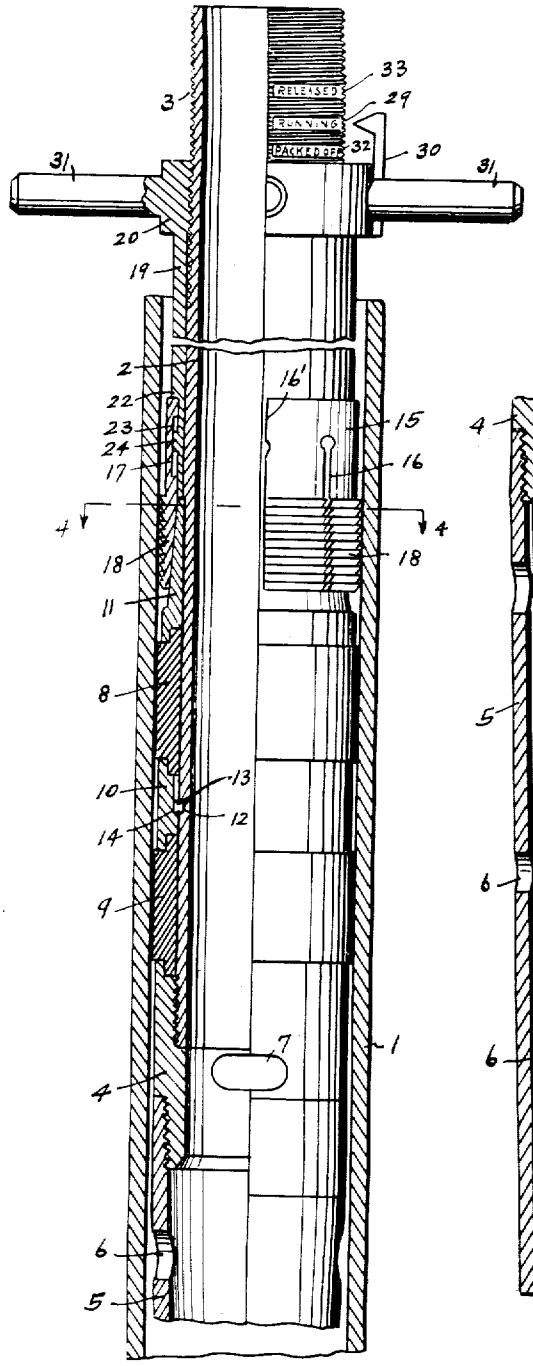


Fig. 2.

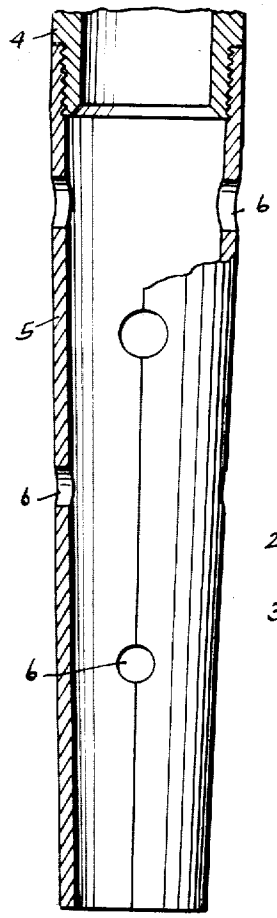


Fig. 3.

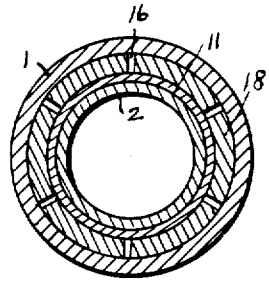


Fig. 4.

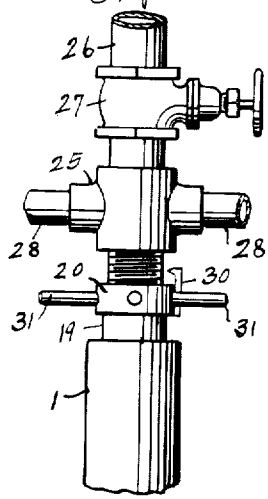


Fig. 1.

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PACK-OFF TOOL

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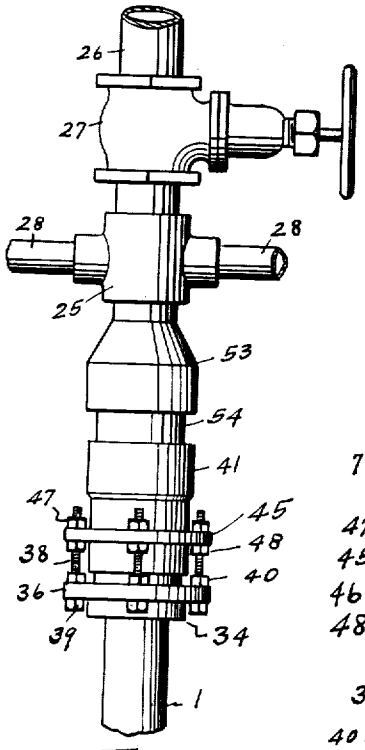


Fig. 5.

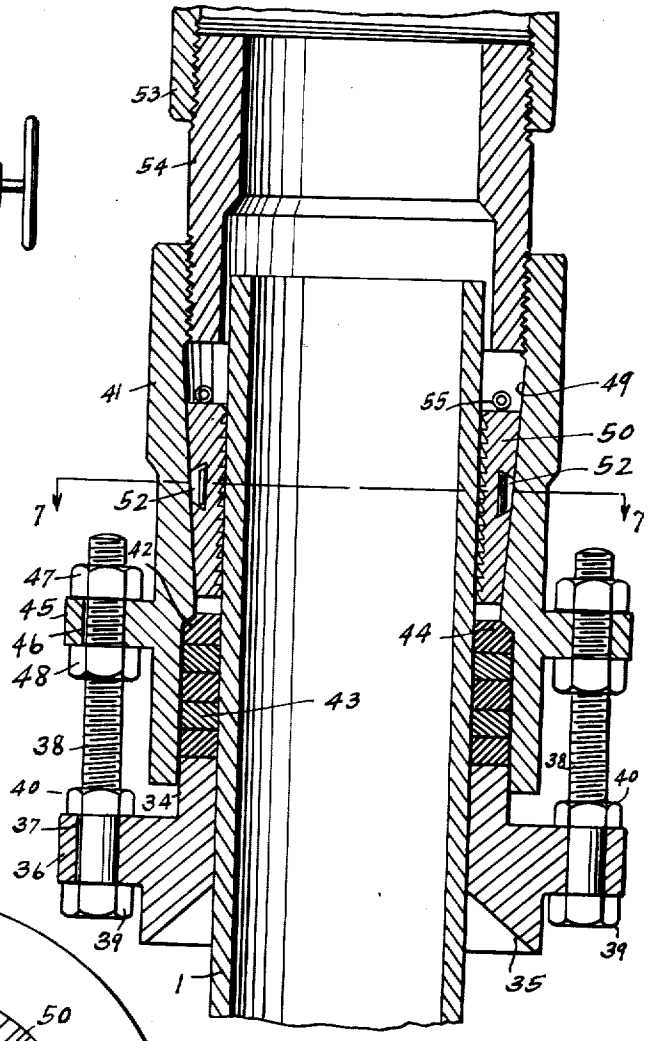


Fig. 6.

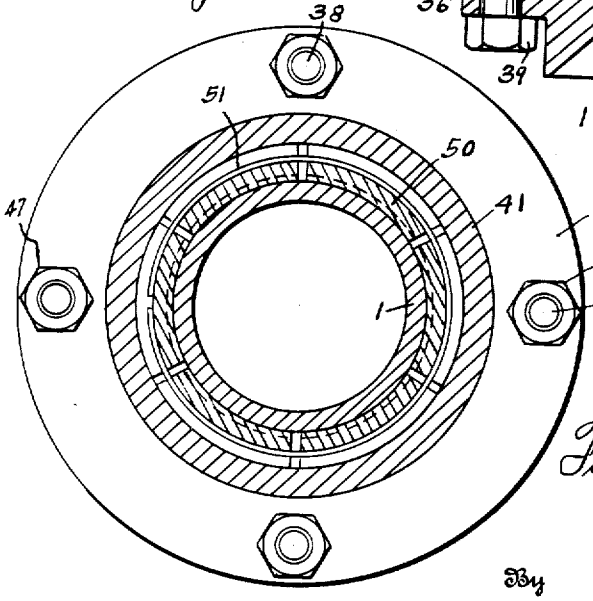


Fig. 7.

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UNITED STATES PATENT OFFICE

1,997,431

PACK-OFF TOOL

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Houston, Tex.

Application November 26, 1932, Serial No. 644,430

4 Claims. (Cl. 285—22)

This invention relates to a pack-off tool.

An object of the invention is to provide a tool of the character described specially designed for the purpose of capping or closing the upper end or mouth of a well against the escape of gas or other fluid, under pressure, from a well.

Another object of the invention is to provide an appliance of the character described that may be readily applied to the upper end of the casing or pipe in a well while the pressure fluid is escaping therefrom, or at other times, and manipulated in such manner as to set a packing to form a fluid tight joint between the tool and the casing.

Another object of the invention is to provide apparatus of the character described whereby the escape of the pressure fluid may be controlled when the tool is applied to the casing and set.

A further object of the invention is to provide a pack-off tool that may be applied either inside or outside of the casing and manipulated to form a fluid tight joint with said casing and to anchor itself against detachment from the casing.

A still further object of the invention is to provide a pack-off tool that may be readily released from the casing and removed.

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

Figure 1 shows a side elevation of the tool as applied to the casing of a well.

Figure 2 shows an enlarged fragmentary vertical sectional view thereof shown in a well casing with the packing ready to be set.

Figure 3 shows a fragmentary side view partly in section of the guide.

Figure 4 is a cross sectional view taken on the line 4—4 of Figure 2.

Figure 5 shows a side view of a form of the tool designed to be applied to the outside of the casing.

Figure 6 shows an enlarged fragmentary vertical sectional view thereof, and

Figure 7 shows a cross sectional view taken on the line 7—7 of Figure 6.

Referring now more particularly to the drawings wherein like numerals of reference designate similar parts in each of the figures, the numeral 1 designates a casing or other pipe in a well to which the pack-off tool is to be applied. In the form of device shown in Figures 1 to 4 inclusive, the numeral 2 designates a tubular packer body whose upper end is externally threaded as at 3 and screwed onto the lower end of which there is a tubular coupling 4. Threaded on to the reduced lower end of the coupling 4 there is a downwardly tapering tubular guide 5 which is provided with suitable perforations 6 spaced apart therealong and the coupling 4 is also provided with a perforation 7.

Around the packer body above the coupling 4 are the expansible upper and lower packers 8, 9 formed of suitable expansible packing material and between these packers 8, 9, there is a spacer sleeve 10. Around the body 2 and above the packer 8 there is an upwardly tapering expander 11. The coupling 4 overlaps the adjacent margin of the packer sleeve 9 and the expander 11 overlaps the adjacent margin of the packer sleeve 8.

Surrounding the body 2 and seated in an annular groove 12 therearound, there is a ring 13 and the spacer sleeve 10 is counter bored from its upper end so that it will fit over said ring 13 and an internal annular shoulder 14 is thus formed in the sleeve 10 which abuts against the underside of the ring 13 to limit the upward movement of said sleeve 10.

Around the expander 11 there is the slip 15 which is tubular in form and this slip has the slots 16 extending from the lower end thereof and spaced apart therearound forming the flexible arms 17 whose lower ends are formed into the outwardly toothed slip jaws 18. The inner sides of these jaws are tapered to conform to the taper of the expander 11. There is a tubular slip actuator 19 around the body whose upper end is formed into the internally threaded nut 20 which is threaded onto the externally threaded upper end of said body. The lower end of the actuator 19 works against the upper end of the expander 11, said lower end being reduced forming the external shoulder 22 which is disposed opposite the upper end of the slip 15. Above the jaws 18 the slip has an internal, annular, counterbore or groove 23, and the actuator 19 has an external annular rib 24 which works in said groove. One of the slits of the slip as 16' extends from end to end of the slip so that in assembly the slip may be sprung open so as to be slipped onto the lower end of the actuator 19 and over the rib 24.

When the apparatus is assembled for use a cross connection 25 is screwed onto the upper end of the body 3 and leading upwardly from said connection 25 there is an outlet pipe 26 incorpo-

rated into which there is a gate valve 27. Leading from the connection 25 are the flow lines 28, 28 of any desired length and controlled by suitable valves of conventional construction.

In case internal pressure is encountered in a well and the fluid flows from the well uncontrolled the apparatus, as shown in Figure 1, may be assembled and elevated above the well by suitable appliance provided for the purpose and then lowered with the guide 5 entering the upper end of the casing. Inasmuch as said guide is tapered downwardly the flow of the fluid from said well will be restricted thereby and the gas or oil flowing around the guide may enter the openings 6, 7 into the guide and pass on up through the body 2 and the pipe 26, the valve 27 being open for this purpose. When the apparatus is thus being lowered the actuator 19 should be adjusted into an intermediate position, indicated on the body at 29 as "running" position. There is a suitable upstanding indicator finger 30, on the upper end of the actuator for this purpose. As the tool is being lowered into the casing the packer sleeve 9 is liable to come into frictional contact with the inner side of the casing 1 which would tend to force said packer 9 upwardly relative to the body 2 but this upward movement is prevented by the engagement of the shoulder 14 with the ring 13 so that the packer sleeve 8 above will not be prematurely expanded while going into the casing. It may be here noted that the spacer sleeve 10 over-laps the adjacent margins of the packer sleeves 8, 9. As the tool is lowered into the casing, the slip jaws 18 will contact yieldingly with the inner wall of the casing 1 and the shoulder 22 will engage the upper end of the slip as shown in Figure 2 forcing said slip downwardly. When the tool is located at the desired point in the casing the body 2 may be pulled upwardly, the actuator 19 moving therewith and this will cause the expander 11 to wedge between the jaws 18 and the body 2 and said jaws will be expanded into engagement with the surrounding casing. The actuator 19 may then be turned to the right by means of the handles 31, 31 provided for the purpose, the shoulder 22 resting on and turning on the upper end of the slip 15 and this will cause a relative upward movement of the body 2. The expander 11 will be held stationary during this upward movement of the body 2 and the coupling 4 will operate against the lower end of the packer sleeve and both of the packer sleeves will thereby be expanded against the casing 1 to form a fluid tight joint thus not only anchoring the pack-off tool to the casing but forming a fluid tight joint between the body 2 and the casing.

The flow lines 28 as above stated will be equipped with conventional valves and by means of these valves and the valve 27 the flow of fluid from the well may be entirely stopped or controlled.

When the actuator sleeve 19 has been rotated as above indicated to set the packers, the indicating finger 30 will indicate that the packer has been set when it is opposite the "packed off" indicator 32 on the body 2.

When it is desired to release and remove the pack off tool from the casing the actuator 19 may be turned to the left and thus elevated relative to the body 1 and as elevated the rib 24 will engage against the shoulder at the upper end of the groove 23 and will elevate the slip jaws 18 off of the expander 11, permitting said jaws to contract and release the casing when the slip is in released position the indicating finger 30 will be opposite the "released" indicator 33 on the body 2 and the tool may then be readily withdrawn from the well casing. In the form shown in Figures 5 to 7 inclusive, there is a tubular guide 34 whose lower end is flared as at 35 to readily pass over the upper end of the casing 1 and this guide has the external annular flange 36 thereon provided with bearings 37 to receive the bolts 38 which are fitted upwardly therethrough. These bolts are secured to the flange 36 by means of the heads 39 on one side of the flange and the lock nuts 40 on the other side thereof. There is a tubular body 41, whose lower end telescopes over the upper end of the guide 34 and has the internal annular shoulder 42 spaced above the upper end of said guide. Suitable packing as 43, rests on the upper end of the guide 34 and is confined between said end and the metal washer 44 which abuts the shoulder 42. The body 41 has an external annular flange 45 therearound having the bearings 46 therethrough to receive the upper ends of the bolts 38 and nuts 47, 48 are screwed onto said bolts, the former above the latter beneath the flange 45. In the body 41 above the packing there is an upwardly flared slip seat 49 on which are the slips 50 which are adapted to surround the casing 1 and whose outer sides are tapered to conform to the taper of the seat 49 and whose inner surfaces are toothed. These slips are held in assembled relation by an open flexible ring 51 which is fitted in the external dovetailed, notches 52 of the slips 50. In this form of the apparatus the cross connection 25 is connected to the body 41 by means of the tubular connecting nipples 53, 54. The cross connection 25, in this form, is equipped with the lateral flow lines 28, 28 and leading upwardly from said cross connection is the outlet line 26 incorporated into which there is the gate valve 27.

In use, this type of the tool may be elevated as hereinabove explained in connection with the type shown in Figure 1 and then lowered over the casing 1, the gate valve 27 in the meanwhile being open. The nuts 48 may then be screwed down on the bolts 38 and the nuts 47 then tightened up to compress the packing 43 so as to form a fluid tight joint with the casing. The valve 27 may then be closed and the tool will be securely anchored to the well casing 1 by means of the slips 50, so that the pack-off tool can not be blown from the casing by the pressure of the well fluid and said fluid may be led off from the well through the lines 28 and controlled by the valves with which said lines are equipped.

When the well has been placed under control and the internal pressure decreases until the pack-off tool is no longer needed the connections above may be disconnected and the nipple 54 unscrewed from the body 41 and the slips 50 may then be removed. In order to release said slip before removal it may be necessary to screw the nuts 48, 47 further down on the bolts 38 and suitable hooks may then be engaged in the eyes 55, 55 and the slips lifted out and the pack-off tools then removed from the casing.

The drawings and description disclose what is now considered to be a preferred form of the invention by way of illustration only while the broad principle of the invention will be defined by the appended claims.

What we claim is:

1. A pack off tool comprising a tubular body, a tubular, downwardly tapering, perforated guide carried by the lower end of said body, packing

around said body, upper and lower abutments confining said packing, an expander on said upper abutment, expansible casing engaging slips associated with said expander, and adapted to be expanded thereby, and means for relatively moving said abutments to effect the expansion and contraction of said packer.

2. A pack-off tool comprising a tubular body shaped to be inserted into the top of a pipe in a well, a tubular perforated guide carried by the lower end of the body, expansible packing around said body, a lower abutment on the body abutting said packing, an upper abutment slidable on the body abutting said packing, an expander above said upper abutment, expansible slips arranged to be expanded by said expander into engagement with the casing, an actuator on, and having a threaded connection with, the body and operatively connected with said slips.

3. A pack-off tool comprising a tubular body shaped to be inserted into the upper end of a pipe in a well, packing around said body, a tubular downwardly tapering perforated guide carried by the body, means slidable on the body and operative against the upper end of said packer, slips engageable with the casing to anchor the tool to said casing, said slips forming means to limit the upward movement of said slidable means, and an actuator operatively connected with said body whereby the body may be moved upwardly in the tool to effect the expansion of said packer.

4. A pack off tool adapted for connection to the upper end of a well casing and comprising a tubular body shaped to telescope with the upper end of a well casing, a guide connected to the lower end of said body adapted to guide the tool into such telescopic relation, packing between the body and casing adapted to close the space between said body and casing, means between the body and casing above the packing engageable with the casing upon upward movement of the body to anchor the body to the casing, means having telescopic relation with the casing beneath the packing effective to compress the packing and means accessible to the operator and having an adjustable connection with said body through which said compressing means may be moved to compress the packing whereby a fluid tight seal is formed between the body and casing.

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