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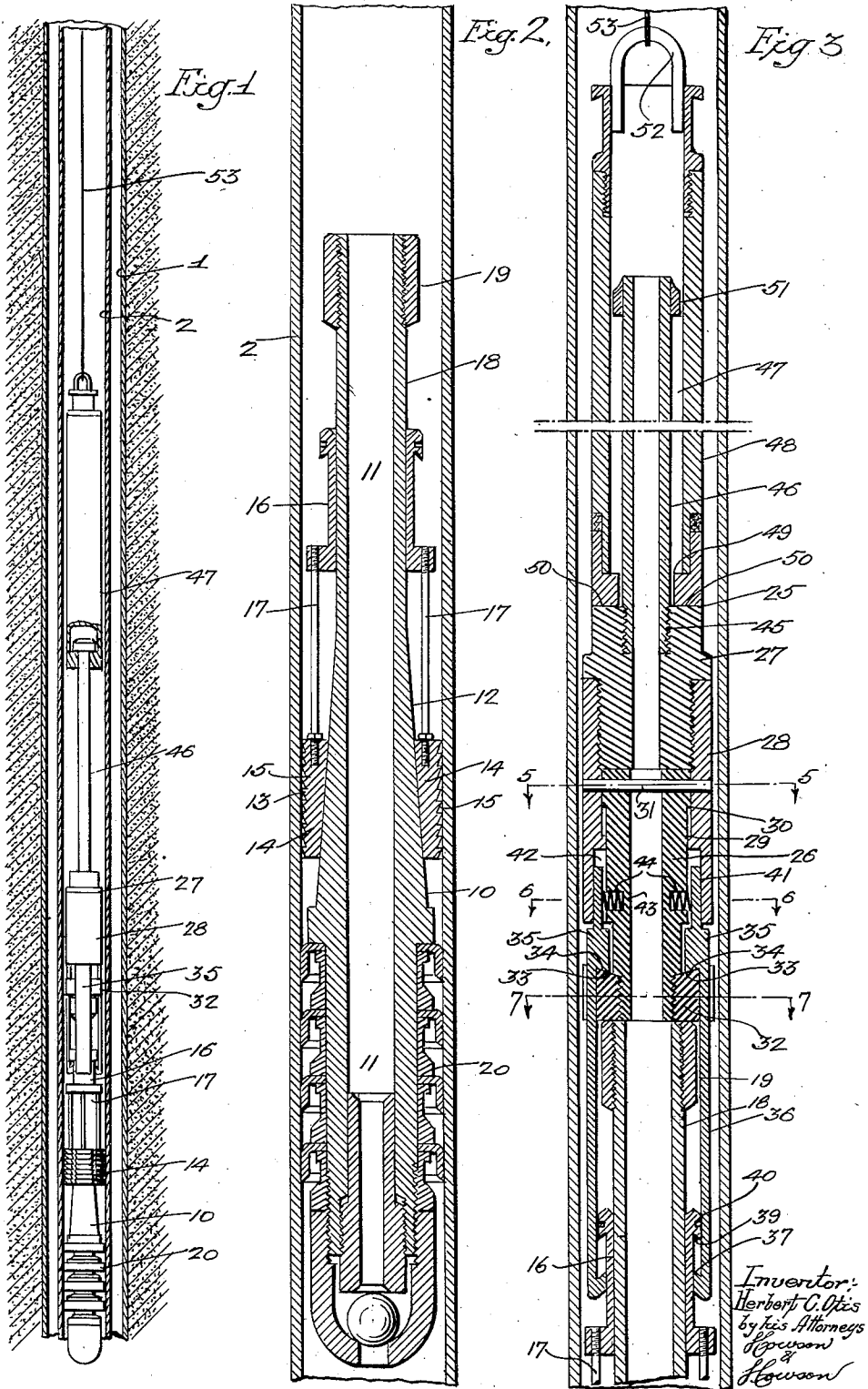
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1,898,261

SAFETY PULLING TOOL FOR WELL EQUIPMENT

Filed Nov. 24, 1931

2 Sheets-Sheet 1



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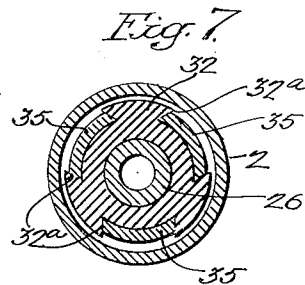
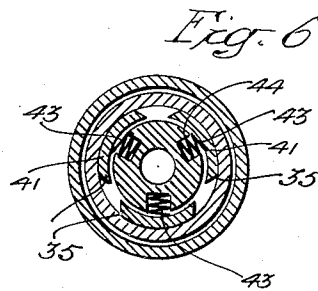
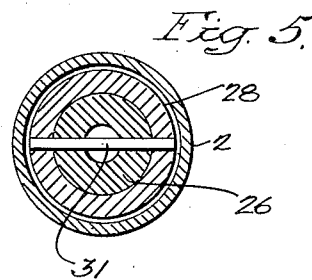
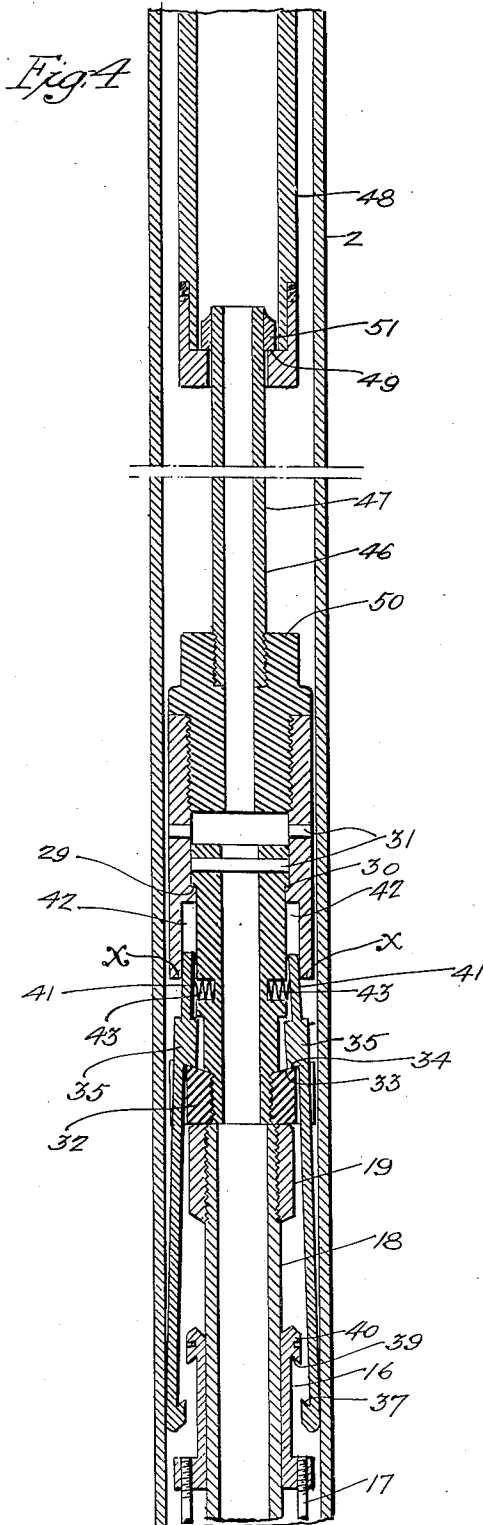
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2 Sheets-Sheet 2



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SAFETY PULLING TOOL FOR WELL EQUIPMENT

Application filed November 24, 1931. Serial No. 577,087.

This invention relates to well tools and particularly to a tool for pulling an obstructive device, such as a plug or choke, from a string of flow tubing disposed in the casing of a well, or for pulling an obstructive device located in the well casing itself.

The present invention relates more specifically to improvements in pulling tools of the type shown and described in my co-pending application, Serial No. 499,372, filed December 1, 1930, in which the pulling tool is shown as effecting the removal of an obstructive device from a string of tubing.

The obstructive device primarily comprises a mandrel having a tapered section on which is operatively mounted a radially expansible gripping element connected to a carrier which is slidably mounted on the mandrel above the tapered section thereof.

The gripping element is expanded radially, to set the obstructive device, by effecting relative movement between the gripping element and its carrier with respect to the mandrel in a direction longitudinally of the mandrel.

Removal of the obstructive device is effected by a reverse relative movement between the above noted elements, by a pulling tool having hooks which engage the carrier and a jarring device adapted to produce hammer blows on the upper end of the mandrel to drive the tapered section thereof downwardly with respect to the gripping element, whereby the gripping element will be contracted radially, thereby releasing the obstructive device from the tubing or casing of the well, as the case may be, whereupon the loosened device will be caught and supported by the hooks of the pulling tool by which the whole assemblage may be raised.

The pulling tool disclosed in the above noted application is provided with no means for releasing the hooks from the device, in event of a failure to loosen the obstructing device in the well.

Should occasion arise wherein the pulling tool after having been lowered into the well, with the hooks in operative relation to the obstructive device and the jarring operation started, if it is found that, for some reason, the mandrel cannot be driven downwardly

to release the obstructive device, which obviously would prevent the raising of the obstructive device, damage to the elements of the obstructive device or to the tubing or well casing would be done if the operators attempted to forcibly pull the device upwardly.

In order to obviate such a condition it is the object of the present invention to provide a pulling tool which can be released from the obstructive device under conditions such as those noted above.

The construction and operation of the device forming the subject of the present invention will be fully disclosed hereinafter, reference being had to the accompanying drawings, of which:

Fig. 1 diagrammatically illustrates a longitudinal sectional elevation of a portion of a well showing the obstructive device located in a string of tubing disposed within the casing thereof, and the pulling tool in position to release the obstructive device from the tubing;

Fig. 2 is an enlarged sectional elevation showing the obstructive device in its set position;

Fig. 3 is a fragmentary view of the upper end of the obstructive device and the jarring device, with the pulling tool forming the subject of the present invention interposed therebetween;

Fig. 4 is a view similar to Fig. 3, but showing the pulling tool as being released from the obstructive device; and

Figs. 5, 6 and 7 are transverse sectional elevations taken respectively on the lines 5-5, 6-6 and 7-7, Fig. 3.

Referring to Fig. 1 of the drawings, a portion of a well casing is indicated at 1. Within the casing 1 is a string of tubing 2 and within the string of tubing is an obstructive device 10.

As shown more clearly in Fig. 2, the obstructive device comprises a mandrel 11 having a tapered section 12 on which is slidably mounted a radially expansible gripping element 13. In the present instance, the gripping element consists of a plurality of segmental shoes or sections 14, 14. Each of the

shoes 14 is provided on the peripheral face of the gripping element with a series of serrations or teeth 15, which are adapted to be pressed into gripping contact with the inner surface of the tubing 2, or the casing 1 as the case may be, by a relative movement between the mandrel 11 and the gripping element 13, in a direction longitudinally of the mandrel.

Each shoe, or slip as they are termed in the field, is operatively connected to a carrier 16, by a link or rod 17. The carrier 16 is slidably mounted on a cylindrical section 18 of the mandrel 11, disposed above the tapered section 12 thereof.

A collar 19 is provided in the upper end of the mandrel 11 to keep the carrier from being removed from the mandrel and to support the mandrel when the obstructive device is released from the tubing, as will be fully disclosed hereinafter.

Below the gripping element 13, the obstructive device is provided with suitable packing means, generally indicated at 20, which prevents escape of fluid upwardly in the tubing around the outside of the obstructive device 10.

The pulling tool 25, in the present instance, comprises a body element 26, a head 27 and a sleeve 28, which encircles both the body and the head and is threaded at its upper end onto the head 27. The sleeve 28 is provided with an annular shoulder 29 which is adapted to co-operate with a corresponding shoulder 30 on the body 26, to allow a limited amount of longitudinal relative movement between the head 27 and the body 26 under conditions hereafter noted.

Such longitudinal movement is normally prevented by a frangible pin 31 which, in the present instance, passes diametrically through the sleeve 28 and the body 26 to maintain the upper end of the body 26 in fixed intimate abutting contact with the lower end of the head 27, with the shoulder 30 of the body 26 spaced from and disposed above the shoulder 29 of the sleeve 28.

The lower end of the body 26 is provided with a radially extending annular shoulder formed by a ring 32 threaded onto the lower end of the body 26 and having an inwardly beveled upper face 33 on which is adapted to rest undercut shoulders 34, 34 of a series of segmental pulling dogs 35, 35, which are disposed around the body 26 in the manner shown in Figs. 6 and 7, said dogs being disposed in and guided by the walls of grooves 32^a formed in the flange 32.

Each dog 35 is provided with a downwardly extending leg 36 having a hook 37 at its lower end for engagement with the undercut face 39 of an annular flange or collar 40 on the upper end of the carrier 16.

Each dog 35 is also provided with an upwardly extending arm 41 which is segmental

in cross section, and is adapted to lie against or parallel to the peripheral surface of the body 26, and within an annular recess 42 formed in the lower end of the sleeve 28, the outer peripheral surface of the arm 41 of each dog 35 being pressed into intimate contact with the inner cylindrical surface of the annular recess 42 by a spring 43, the outer end of which bears against the inner face of the arm 41 while the inner end bears against the base of a suitable socket 44 formed in the body 26.

The upper end of the head 26 is threaded to receive a correspondingly threaded end 45 of the shank 46 of a jarring device 47.

The jarring device in the present instance comprises a cylinder 48 within which the shank 46 is axially aligned, the cylinder having an inward radially extending annular flange 49 which is adapted to rest on and deliver a hammer blow to an upper annular ledge 50 of the head 27, such blow being transmitted through the head 27 to the body 26 and thence to the upper end of the mandrel 11, upon which the body 26 rests.

The cylindrical section 48 of the jarring device is adapted to receive axial reciprocation with respect to the shank 46 which, as above noted, is held stationary by the head 27 of the pulling tool 25.

The shank 46 is provided with a collar 51 at its upper end within the cylinder 48 which co-operates with the flange 49 of the cylinder to prevent separation of these two parts of the jarring device.

At the upper end of the cylinder 48 is a bail 52 to which a cable 53 is attached, in the present instance, for lowering the assembled jarring and pulling devices into the well, for effecting relative reciprocation between the two parts of the jarring device after the assemblage is seated on the upper end of the mandrel, and for raising the said assemblage together with the obstructive device which is supported solely by the hooks 37 of the pulling tool dogs 35 after the gripping element 23 has been loosened by operation of the jarring device.

If the obstructive device is not loosened by the jarring operations and force is applied to the cable 53 in an attempt to forcibly pull the obstructive device upwardly through the tubing 2 such force will effect shearing of the frangible pin 31, whereupon the head 27 and sleeve 28 will be raised with respect to the body 26, which is then held against vertical movement by the hooks 37 of the dogs 35 underlying the undercut face 39 of the flange 40 on the carrier 16, the carrier in turn being held against upward movement by the slips 14, 14 jammed against the inner wall of the tubing 2 by the tapered section 12 of the mandrel 11.

The vertical movement of the sleeve 28 relative to the arms 41 of the dogs 35, from the

position shown in Fig. 3 to that shown in Fig. 4, permits the springs 43 to become effective to force the hooks 37 of the dogs 35 from beneath the undercut face 39 of the flange 40 of the carrier 16, thus releasing the dogs 35 from the obstructive device, the dogs 35 turning about the points *a* as a fulcrum in swinging the hook ends 37 thereof from under the flange 4.

10 In raising the freed pulling tool out of the well the annular shoulder 29 of the sleeve 28 engages the annular shoulder 30 on the body 26, to prevent separation of these elements, as shown in Fig. 4. The sleeve 28, at the same time, by overlapping the upper ends of the arms 41 of the dogs 35 prevents the shoulders 34 of the dogs 35 from moving outwardly off the inwardly beveled shoulder 33 of the body 26.

20 In the drawings, in the present instance, the shank 46, head 27, and body 26 are shown as being hollow or having a longitudinally extending opening to permit the by-passing of any fluid present in the tubing 2 above the obstructive device 10 as the assembled jarring device and pulling tool are being lowered into the well, but obviously, as this assemblage does not closely fit within the tubing 2, such fluid may pass around the outside thereof, in which case the shank 46, body 26 and head 27 may be made solid.

I claim:

1. In a tool for removing an obstructive device from a well, the combination of means for engaging said obstructive device, means for supporting the engaging means, means for pulling said supporting means, releasable means operatively connecting said pulling and supporting means, and means for disconnecting the engaging means from the obstructive device upon relative movement between the said pulling means and said supporting means effective upon release of said releasable means.

2. In a tool for removing an obstructive device from a well, the combination of means for engaging said obstructive device, means for supporting said engaging means, means for pulling said supporting means, frangible means operatively connecting the pulling and supporting means, and means for disconnecting the engaging means from the obstructive device upon relative movement between the pulling means and supporting means as a result of breaking of the frangible connection therebetween.

3. In a tool for removing an obstructive device from a well, the combination of means for engaging said obstructive device, means for supporting said engaging means, means for pulling said supporting means, frangible means operatively connecting the pulling and supporting means, means normally tending to disconnect the engaging means from the obstructive device, and means opposing the

action of said disconnecting means until relative movement is effected between the pulling and supporting means as permitted by the breaking of said frangible connection therebetween.

4. In a tool for removing an obstructive device from a well, the combination of means for engaging said obstructive device, means for supporting said engaging means, means for pulling said supporting means, frangible means operatively connecting the pulling and supporting means, means carried by the supporting means and normally tending to disconnect the engaging means from the obstructive device, and means carried by the pulling means opposing the action of said disconnecting means until relative movement is effected between the pulling and supporting means as permitted by the breaking of said frangible connection therebetween.

5. In a tool for removing an obstructive device from a well, the combination of means for engaging said obstructive device, means for supporting said engaging means, means for pulling said supporting means, frangible means operatively connecting the pulling and supporting means, means normally tending to disconnect the engaging means from the obstructive device, means opposing the action of said disconnecting means until relative movement is effected between the pulling and supporting means as permitted by the breaking of said frangible connection therebetween, and means for limiting the extent of said relative movement between said pulling and supporting means.

6. In a tool for removing an obstructive device from a well, the combination of a body element, a pulling dog carried by said body element for engaging said obstructive device, actuating means normally tending to disengage the dog from the obstructive device, a head element, means carried by the head element and normally opposing the said disengagement of the dog, and releasable means operatively connecting the head and body elements and preventing such relative movement therebetween as would release the dog.

7. In a tool for removing an obstructive device from a well, the combination of a body element, a pulling dog carried by said body element for engaging said obstructive device, actuating means normally tending to disengage the dog from the obstructive device, a head element relatively fixed normally with respect to said body element, means carried by the head element and normally opposing the said disengagement of the dog, and frangible means effecting said fixed relation between the said head and body element and arranged to be broken to permit of such relative movement between the head and body elements as would effect release of the dog.

8. In a tool for removing an obstructive device from a well, the combination of a body

element, a pulling dog carried by said body element for engaging said obstructive device; actuating means normally tending to disengage the dog from the obstructive device, a head element relatively fixed normally with respect to said body element, means carried by the head element and normally opposing the said disengagement of the dog, frangible means effecting said fixed relation between the said head and body element and arranged to be broken to permit of such relative movement between the head and body elements as would effect release of the dog, and means for limiting the extent of said relative movement between said elements.

9. In a tool for removing an obstructive device from a well, the combination of a body element, a pulling dog carried by said body element for engaging said obstructive device, a spring normally tending to disengage the dog from the obstructive device, a head element relatively fixed normally with respect to said body element, means carried by the head element and normally opposing the said disengagement of the dog, and releasable means operatively connecting the head and body elements and preventing such relative movement therebetween as would release the dog.

10. In a tool for removing an obstructive device from a well, the combination of a body element, a pulling dog carried by said body element for engaging said obstructive device, actuating means normally tending to disengage the dog from the obstructive device, a head element axially aligned with said body element, an extension of and projecting from said head into engagement with the dog and normally opposing the said disengagement of the dog, and releasable means operatively connecting the head and body elements and preventing such relative movement therebetween as would release the dog.

11. In a tool for removing an obstructive device from a well, the combination of a body element, a pulling dog carried by said body element for engaging said obstructive device, actuating means normally tending to disengage the dog from the obstructive device, a head element axially aligned with said body element, a sleeve extending from the head element and around the body element and the dog carried thereby, and releasable means operatively connecting the head and body elements and preventing such relative movement therebetween as would release the dog.

12. In a tool for removing an obstructive device from a well, the combination of a body element, a head element, actuating means normally tending to disengage the dog from the obstructive device, a head element axially aligned with said body element, a sleeve extending from the head element and around the body element and the dog carried thereby, and a frangible pin extending diametri-

cally through the sleeve and the body element for normally preventing such relative movement therebetween as would effect release of the dog.

13. In a tool for removing an obstructive device from a well, the combination of a body element, a pulling dog carried by said body element for engaging said obstructive device, actuating means normally tending to disengage the dog from the obstructive device, a head element axially aligned with said body element, a sleeve extending from the head element and around the body element and the dog carried thereby, a frangible pin extending diametrically through the sleeve and the body element for normally preventing such relative movement therebetween as would effect release of the dog, and a shoulder on the sleeve co-operating with a corresponding shoulder on the body element for limiting the extent of relative movement therebetween.

14. In a tool for removing an obstructive device from a well, the combination of a body element, an annular shoulder on the lower end of said body element, a series of segmental pulling dogs resting on said annular shoulder and disposed in circumferentially spaced relation around the body element and having downwardly extending legs disposed in guide grooves formed in the said annular shoulder, and arms extending above said shoulder, a head element axially aligned with said body element, a sleeve carried by the head element and extending downwardly around the body element and the upwardly extending arms of the dogs, springs seated in cavities formed in the body element and bearing against the inner faces of said dog arms, and a frangible pin extending diametrically through the sleeve and the body element for normally preventing such relative movement therebetween as would effect release of the dog.

15. In a tool for removing an obstructive device from a well, the combination of a pulling device engaging the said obstructive device, a jarring device for loosening said obstructive device in the well, and means for releasing the pulling device from the obstructive device in event of failure of the jarring device.

16. In a tool for removing an obstructive device from a well, the combination of a pulling device engaging the said obstructive device, a jarring device for loosening said obstructive device in the well, and frangible means for releasing the pulling device from the obstructive device in event of failure of the jarring device.

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