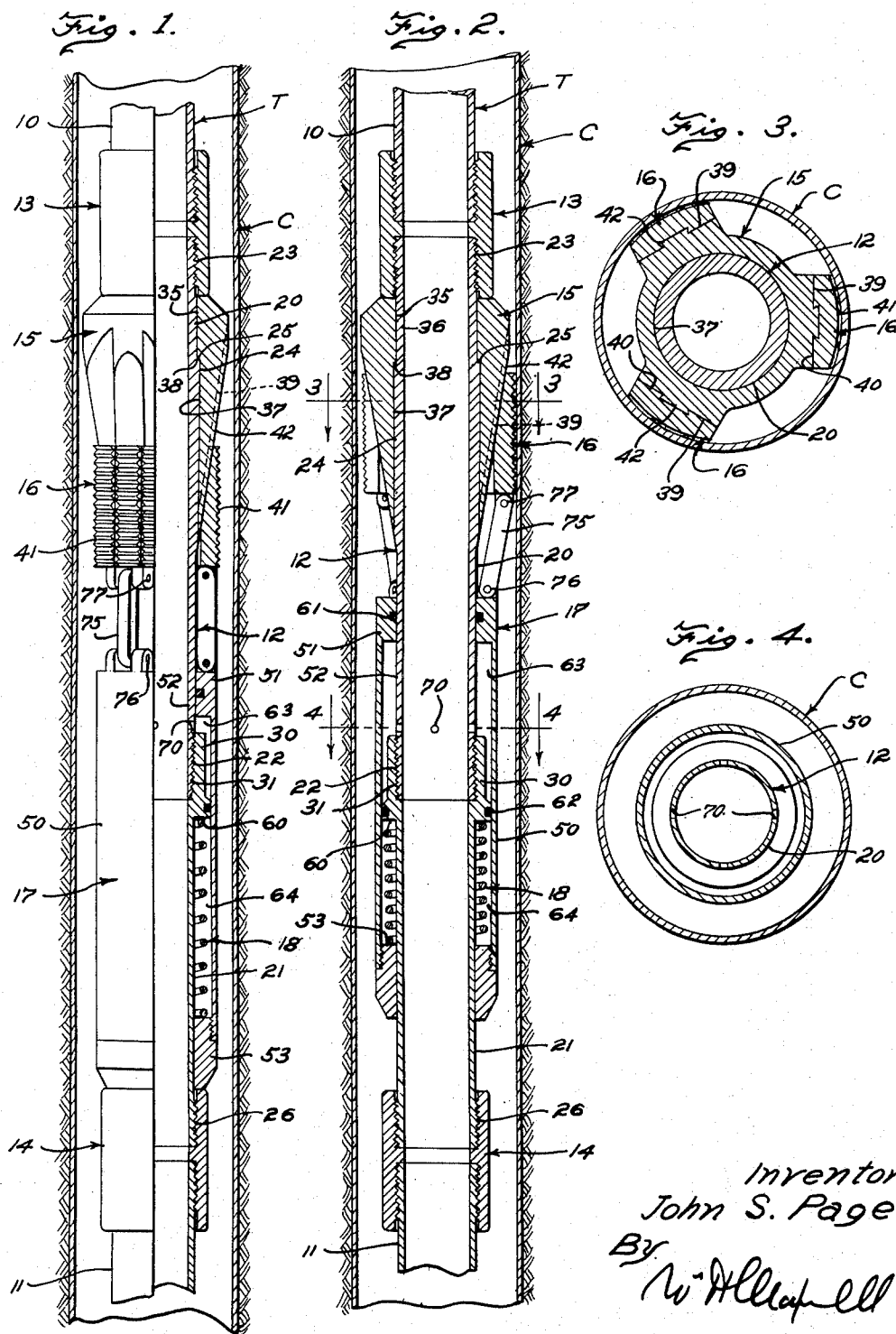


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J. S. PAGE
HYDRAULICALLY OPERATED ANCHOR
FOR TUBING OR THE LIKE
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Inventor
John S. Page
By
W. H. Hall
Attorney

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HYDRAULICALLY OPERATED ANCHOR FOR
TUBING OR THE LIKE

John S. Page, Long Beach, Calif., assignor to Page
Oil Tools Inc., Long Beach, Calif., a corpora-
tion of California

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This invention relates to a hydraulically operated anchor for tubing, and the like, and it is a general object of the invention to provide such an anchor which is of simplified practical and improved form and construction.

Tubing anchors are employed in wells to anchor or secure tubing within casing or the like and with the ordinary construction heretofore proposed difficulties have been experienced in obtaining an effective, secure anchoring action or in providing an anchor which may be released when it is desired or necessary to remove the tubing.

It is a general object of this invention to provide a tubing anchor of simplified practical construction which acts to anchor a tubing or the like in a most effective or advantageous manner and which is such that it can be released whenever desired by simply lifting upon the tubing. The anchor of the present invention can be used generally where it is desired to anchor tubing or the like in a well, and it is particularly useful as a unit of the apparatus and in carrying out the method which are the subject of my co-pending application entitled "Method and Apparatus for Establishing a Well Pump in Working Position in a Well," Serial No. 742,938, filed on even date herewith, now abandoned.

Another object of my present invention is to provide an anchor of the general character referred to involving a central tubular body and a wedge head on the body which head is formed separately from the body and is applied thereto in a manner to be effectively held on the body for cooperation with slips.

Another object of the present invention is to provide an anchor of the general character referred to involving hydraulic operating means which acts to effect relative movement between the wedge head and slips so that they do not move relative to each other with the result that the structure effectively grips wherever it is operated and continues to grip even though the anchor may be bodily shifted slightly in a casing or the like in which it is engaged.

Another object of the present invention is to provide an anchor of the general character referred to including hydraulic operating means involving a working barrel surrounding the body and slidable along the body, which barrel is packed with the body at its upper end to exclude sand or other foreign matter that otherwise might enter the barrel to interfere with proper operation of the tool.

A further object of the present invention is

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to provide an anchor of the general character referred to including a reaction spring housed in the barrel or operating means so that it is protected and is shielded against becoming sand-
ed up or otherwise fouled by foreign matter.

It is a further object of the invention to provide a simplified anchor construction of the general character referred to wherein the body is sectional making it simple of manufacture and particularly simple to assemble with the other parts of the structure.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a view showing the anchor of the present invention within a casing and incorporated in a string of tubing with the anchor shown retracted or unactuated and with parts of the structure shown in section. Fig. 2 is a longitudinal detailed sectional view of the anchor showing it set or fully actuated. Fig. 3 is an enlarged plan sectional view taken as indicated by line 3—3 on Fig. 2, and Fig. 4 is an enlarged plan sectional view taken as indicated by line 4—4 on Fig. 2.

The structure of the present invention is intended primarily for use on or in a string of tubing T in a casing C. In the case illustrated the anchor is shown inserted in the tubing string between the upper portion 10 of the string and the lower portion 11 thereof. The anchor involves, generally, a central elongate tubular body 12, a coupling 13 joining the upper end of the body to the tubing section 10, a coupling 14 joining the lower end of the body to the lower tubing section 11, a wedge 15 carried by the body preferably at the upper end portion thereof, slips 16 cooperatively engaged with the several operating means carried by the body below the wedge, a hydraulic operating means 17 and a reaction spring 18 carried or housed by the means 17.

The body 12 of the tool is preferably a simple, elongate tubular structure formed of upper and lower sections 20 and 21 respectively, which sections are joined by suitable coupling means 22. The upper section 20 of the body is threaded at 23 to receive the coupling 13 by which the body is joined to the tubing section 10. The body section 20 has an enlarged portion 24 intermediate its ends which portion forms a seat on which the wedge is carried. An upwardly facing shoulder 25 occurs at the upper edge of the portion 24 and

forms a support for the wedge as clearly shown in Figs. 1 and 2 of the drawings. The lower section 21 of the body 12 is threaded at 26 to receive the coupling 14 by which the body is joined to the tubing section 11.

The means 22 joining or coupling the body sections 20 and 21 is preferably a threaded connecting means and in the case illustrated it involves an internally threaded sleeve portion 30 on one body section and a pin portion 31 on the other body section, which pin portion is threaded into the sleeve. In the preferred arrangement the sleeve 30 is in the nature of an enlargement on the upper end portion of the lower body section 21 while the pin portion 31 is formed by merely threading the lower end portion of the body section 20.

The wedge 15 is a sleeve-like member surrounding and carried by the upper body section 20 and in accordance with my invention the upper end portion of the wedge is bored at 35 to receive the upper end portion 36 of body section 20 occurring above the wedge seat 25. The wedge 15 is counterbored at 37 from its lower end to receive the seat portion 24 of body section 20. Between the bores 35 and 37 there is a downwardly facing shoulder 38 which engages and rests upon the upper upwardly facing shoulder 25 on body section 20. The wedge 15 is arranged in position on the body section 20 by being slid over the threaded end portion 23 and when in place with the shoulders 25 and 38 in engagement the collar or coupling 13 is applied to the threaded portion 23 to form a retainer holding the wedge in place on the body section 20. Through this construction the body section 20 is a part simple and inexpensive of manufacture and likewise the wedge 15 is a simple sleeve-like part simple of manufacture.

The exterior of the wedge 15 is provided with a plurality of downwardly and inwardly extending wedge faces 39 on which the slips 16 are carried. In practice the number and arrangement of slip faces 39 may be varied. However, ordinarily it is desirable to provide three slip faces equally spaced around the wedge as illustrated in Fig. 3 of the drawings.

Slips 16 may be simple, conventional gripping devices or slips such as are common to oil well tools in which case they have inner faces 40 slidably carried on the wedge faces 39 and they have outer gripping faces 41 that may be toothed or otherwise finished to have the desired gripping action. In the preferred form of the invention the slips are joined to and are guided on the wedge by means of dove-tailed guides 42 which extend lengthwise of the tool.

The hydraulic operating means 17 that I have provided includes, generally, a cylindrical barrel 50 which surrounds and works over a substantial portion of the body 12, that is, over the lower end portion of the body section 20 and the upper end portion of body section 21. A head 51 closes the upper end of barrel 50 and is slidably engaged on the lower end portion 52 of body section 20. A head 53 closes the lower end of the barrel 50 and is slidably carried on the body section 21. In accordance with my construction the head 51 is fixed to or may be integral with the barrel 50 as shown in the drawings, whereas the head 53 is detachably connected to the barrel as by a threaded connection, with the result that in assembly the head 51 is slid onto the lower end portion 52 of body section 20 whereupon body section 21 is coupled with body section 20 through

the connecting means 22 after which the head 53 is slid over the lower end of body section 21 and is threaded to the barrel 50. An enlargement or flange is provided on the body 12 between the heads 51 and 53, preferably on the sleeve 30 of means 22 to form piston part 60 which slidably fits the interior of barrel 50. In accordance with my invention a sealing means or ring 61 is carried by the head 51 to provide sealing engagement between the head 51 and portion 52 of body section 20 and packing, or a packing ring, 62 is carried by the piston 60 to seal between the piston 60 and the interior of the barrel 50, dividing the barrel into upper and lower chambers 63 and 64, respectively.

The reaction spring 18 is a helical compression spring and is carried on the body portion 21 between the piston 60 and the head 53 to normally, yieldingly urge the barrel 50 downwardly relative to the body. The downward movement of the barrel is stopped through engagement of the head 53 with the upper end of the coupling 14 by which the body is coupled to the tubing section 11. In accordance with my invention one or more ports 70 are provided in the portion 52 of body section 20 preferably just above the means 22, which ports connect the interior of the body with the chamber 63 at the upper end of barrel 50. Through the ports 70 fluid introduced into the tubing T or into the body of the anchor passes through the ports into the chamber 63 and when the pressure of such fluid is sufficient the barrel 50 is forced upwardly relative to the body 12 against the action of the spring 65.

I provide coupling means between the barrel 50 and the slips preferably in the form of links 75 coupled to the barrel by pivot pins 76 and to the slips by pivot pins 77.

With the construction that I have provided the anchor secured to or in the tubing T, as shown in the drawings, is lowered into the casing C to the desired position, whereupon fluid pressure is established in the tubing so that fluid passes through the ports 70 and into the chamber 63 to force the barrel 50 upwardly. As the barrel is moved upwardly relative to the body 12 the slips are moved upwardly on the wedge 15 and through the tapered engagement between wedge and slips the slips are moved outwardly into gripping engagement with the casing. The wedge engagement of the slips with the casing provides a positive check against downward movement of the tubing and so long as a head of fluid is maintained in the tubing the slips are held up on the wedge and in gripping engagement with the casing. At any time that it is necessary to withdraw the tubing it is merely necessary to pull it upwardly in order to lift or tend to lift the wedge out of the slips and thus release or relieve the gripping action of the slips so that the tubing can be moved up in the casing. During insertion of the anchor into the casing the spring 18 maintains the barrel in the down or retracted position.

Through the construction that I have provided the parts may be fitted and related so that the tubing T can be turned relative to the anchor if such action is desired. It will be apparent that the parts can be assembled so that the body section 20 can turn within the wedge 15 and the body section is free to turn within the barrel 50, with the result that the wedge 15 and slips may remain set while the tubing T is turned in either direction relative to the seat parts. So long as a

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head of fluid is maintained in the tubing the barrel 50 is urged upwardly relative to the body 12 or it may be considered that the body 12 is urged downwardly relative to the barrel to the end that whichever part or element is free to move or can be shifted does move relative to the other part with consequent gripping action, which serves to effectively anchor the tubing in the casing.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and fall within the scope of the following claims.

Having described my invention, I claim:

1. A tubing anchor including, an elongate tubular body carrying a piston, a wedge carried by the body, slips cooperating with the wedge, and operating means for the slips including, a barrel surrounding the body with clearance and with the piston slidably engaged therein, a spring around the body and within the barrel normally yieldingly urging the barrel in one direction along the body, and a head closing one end of the barrel, there being a port in the body admitting fluid from within the body to within the barrel between the head and piston.

2. A tubing anchor including, an elongate tubular body carrying a piston, a wedge carried by the body, slips cooperating with the wedge, and operating means for the slips including, a barrel surrounding the body with the piston slidably engaged therein, a head closing the upper end of the barrel, there being a port in the body admitting fluid from within the body to within the barrel between the head and piston, a spring surrounding the body below the piston and located within and bearing on the barrel to normally yieldingly hold the barrel against upward movement on the body, and packing between the head and body.

3. A tubing anchor including, an elongate tubular body carrying a piston, a wedge carried by the body, slips cooperating with the wedge, and operating means for the slips including, a barrel surrounding the body with the piston slidably engaged therein, a head closing one end of the barrel, there being a port in the body admitting fluid from within the body to within the barrel between the head and piston, a head closing the other end of the barrel, and a spring within the barrel between the piston and the last mentioned head.

4. A tubing anchor including, an elongate tubular body carrying a piston, a wedge carried by the body, slips cooperating with the wedge, and operating means for the slips including, a barrel surrounding the body with the piston slidably engaged therein, a head closing one end of the barrel, there being a port in the body admitting fluid from within the body to within the barrel between the head and piston, a head closing the lower end of the barrel, and a compress-

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sion spring in the barrel between the lower side of the piston and the last mentioned head.

5. A tubing anchor including, an elongate tubular body, a piston on the body intermediate its ends, a wedge on the body, slips cooperating with the wedge, a barrel surrounding the piston and operatively connected with the slips, heads at the ends of the barrel closing the ends thereof, and a spring in the barrel between the piston and one head normally yieldingly urging the barrel in one direction, there being a port in the body between the piston and the other head to admit fluid to the barrel to operate it in the opposite direction.

6. A tubing anchor including, an elongate tubular body having two sections and means detachably connecting the sections, a wedge sleeve on the body, slips cooperating with the sleeve, a barrel on the body surrounding said means and operatively connected with the slips, a head on one end of the barrel slidably engaging one section of the body, a head on the other end of the barrel slidably engaging the other section of the body, a piston carried by said means and slidably engaging the barrel, and a spring on one section of the body within the barrel between the piston and one head, there being a port in the other section of the body admitting fluid to the barrel between the piston and the other head.

7. A tubing anchor including, an elongate tubular body having two sections and means detachably connecting the sections, a wedge sleeve on the body, slips cooperating with the sleeve, a barrel on the body surrounding said means and operatively connected with the slips, a head on one end of the barrel slidably engaging one section of the body, a head threaded to the other end of the barrel slidably engaging the other section of the body, a piston carried by said means and slidably engaging the barrel, and a spring on one section of the body within the barrel between the piston and the head which is threaded to the body, there being a port in the other section of the body admitting fluid to the barrel between the piston and the other head.

JOHN S. PAGE.

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