

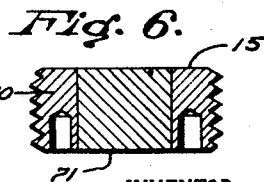
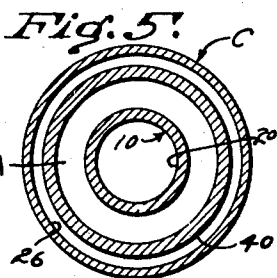
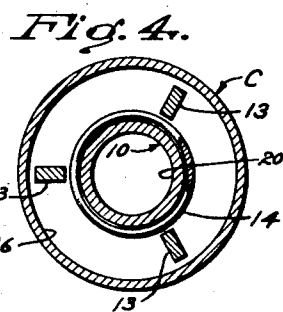
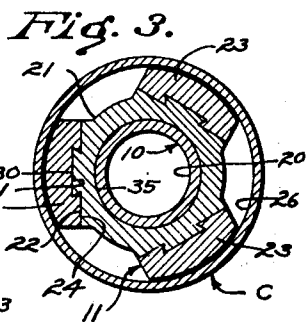
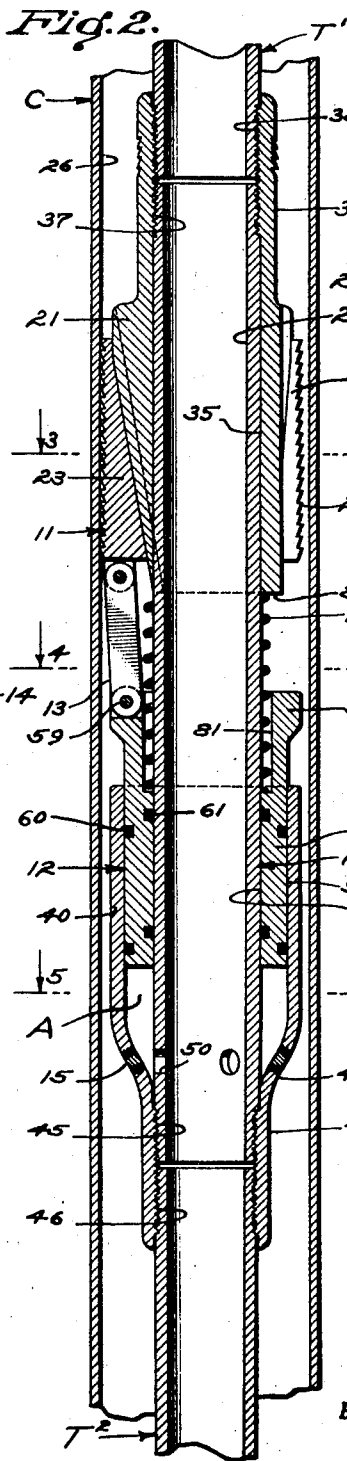
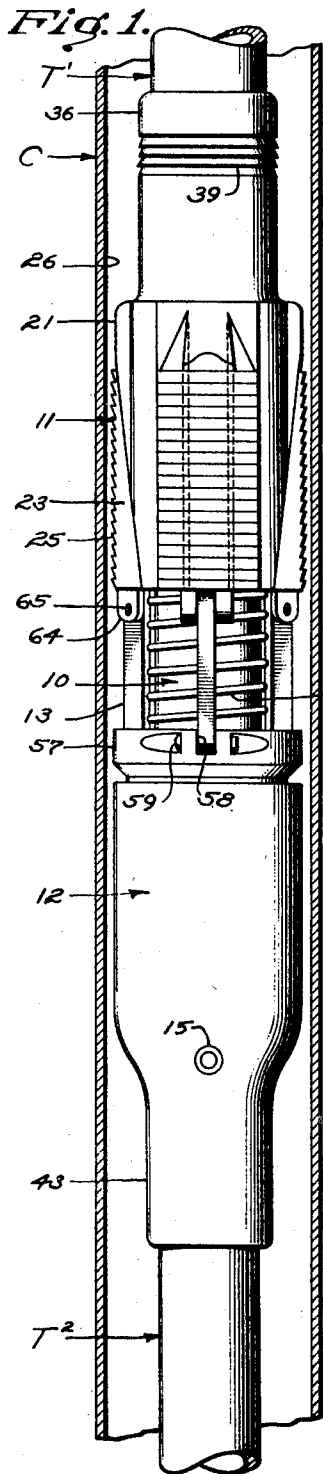
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J. S. PAGE

2,435,899

TUBING ANCHOR

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TUBING ANCHOR

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1

This invention has to do with a tubing anchor it being a general object of the invention to provide a simplified, improved, anchoring device to be used on or in connection with a string of tubing to anchor it in a casing or the like. Tubing anchors are commonly employed in wells such as oil wells and particularly where wells are being pumped, the primary purpose of such devices being to fix or anchor the tubing within a casing or the like at a suitable point in the well, to eliminate or minimize difficulties that result from working or movement of tubing within the casing.

It is a general object of this invention to provide an improved, simplified anchor of the general type which is the subject of Letters Patent of the United States No. 2,332,749, issued to me October 26, 1943. With this type of anchor the tubing can be set in a most advantageous manner and the actual setting or actuation of the gripping means involved in the anchor is controlled hydraulically or by means of fluid in the tubing being set.

A general object of the present invention is to provide a tubing anchor of the general character referred to which involves a minimum number of simple, inexpensive, parts, all of which are easily applied for use and are uniform and dependable in operation.

It is a further object of my invention to provide an anchor of the general character referred to which involves a single angular element that serves both as the operating or actuating piston and as the carrier for the links which connect to the slips of the gripping means.

A further object of the present invention is to provide an anchor of the general type referred to wherein there is a single simple helical spring that serves to normally yieldingly hold the mechanism in a released or unactuated position, which spring is arranged so that it is exposed or is at the exterior of the structure. By locating the spring so that it is exposed and at the exterior of the structure I eliminate danger of bending or clogging such as may occur if the spring is confined in a chamber.

Another object of my present invention is to provide an anchor of the general character referred to which has a central continuous uniform body that extends from one end of the structure to the other so that during normal operations fluid is conducted through the body without restriction and without eddy currents or disturbances of any kind. With the construction that I have provided the body of the anchor acts generally in the same manner as a length or section

2

of tubing of the tubing string, so that the anchor does not in any way interfere with flow through the tubing.

Another object of my present invention is to provide an anchor of the character mentioned involving a hydraulic actuator including a blow out means acting to relieve operating pressure to release the slips or gripping means from the casing in which the anchor is set.

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 side elevation of the anchor that I have provided showing it within a well casing and showing the parts unactuated or in a position which allows the anchor to be moved freely through the casing. Fig. 2 is a longitudinal detailed sectional view of the anchor showing it in a well casing and showing it actuated or set. Fig. 3 is a detailed transverse sectional view taken substantially as indicated by line 3-3 on Fig. 2. Fig. 4 is a detailed transverse sectional view taken substantially as indicated by line 4-4 on Fig. 2. Fig. 5 is a detailed transverse sectional view taken substantially as indicated by line 5-5 on Fig. 2, and Fig. 6 is a detailed sectional view of a blow out plug employed in the construction.

The anchor that I have provided can be used to advantage in a well or the like where it is desired to anchor an element such as a well tubing and since such a device is most commonly used for anchoring a tubing in a casing I will describe the invention as employed in such a situation. Further, in accordance with the broader aspects of my invention the structure can be used or manipulated in various ways. However, it is most advantageous to operate or actuate it by means of fluid carried by the tubing which is being anchored, and in practice it is ordinarily desirable to set the anchor so that there is stretch in the tubing.

In the drawings I have shown a typical well casing C with a string of tubing arranged or extending through it. The anchor of the present invention is shown connected in the tubing so that it is, in effect, an insert in the tubing, and so that it divides the tubing into an upper section T' and a lower section T². The anchor that I have provided may be employed or inserted in the tubing between the sections T' and T² in place of an ordinary tubing coupler and there-

3

fore it is applicable to any point along the tubing and can be readily located wherever desired, for instance, at the lower end of the tubing, or at any point intermediate the ends of the string of tubing.

The anchor that I have provided involves, generally, certain essential elements, namely a body 10, a gripping means or a slip mechanism 11, and hydraulic actuating means 12 for the slip mechanism 11. There are various other elements that enter into the structure, such for example as links 13 that connect the means 12 and the mechanism 11, a spring 14 that normally yieldingly holds the mechanism in an unactuated position, and one or more blow out plugs 15.

The body 10 that I have provided is of improved form in that it is a straight simple elongate tube, uniform in size throughout its length and threaded at its ends for connection to the tubing sections by couplers included in the construction. The body is centrally located or is concentric with the longitudinal axis of the structure and it is preferably proportioned so that the opening 20, which extends continuously longitudinally through it from one end to the other corresponds in size to the opening afforded by the tubing to which the device is connected. In the preferred form of the invention the end portions of the body are externally threaded so that no parts of the structure enter the body to restrict it in any way.

The slip mechanism 11 may be of any suitable form or construction, it being preferred to follow a somewhat conventional slip construction which is characterized by a single central abutment carrying a plurality of gripping members or slips. The abutment 21 shown in the drawings surrounds the upper end portion of the body 10 and is formed at its outer side or exterior with a plurality of longitudinally extending inclined faces 22 which converge or extend downwardly and inwardly, as clearly shown in the drawings. In the particular case illustrated there are three faces 22 and there is a slip or gripping member 23 slidably carried on each face 22. The slips 23 have flat inner sides 24 to slidably bear on the faces 22 and have curved outer sides with teeth 25 to engage the inner wall 26 of the casing C. In practice it is generally desirable to form the slips so that the curved outer faces thereof fit or conform to the inner wall of the casing when the slips are expanded to grip the casing.

In practice it is preferred to guide the slips lengthwise of the faces 22. In the particular case illustrated I show a tongue and groove connection between each slip and its supporting abutment. I show a tongue 30 projecting from each face 22 and extending longitudinally thereof and a dove-tailed groove 31 is provided longitudinally in each slip to accommodate the tongue 30.

The abutment 21 of the slip mechanism has a central bore 35 that slidably passes the upper end portion of the body 10 and the abutment member is provided at its upper end with a tubular extension which forms a coupler 36. The coupler 36 is internally threaded at 37 so that the upper end of the body is screw threaded into it and it is internally threaded at 38 to receive the lower end of the tubing section T'. The coupler 36 may be considerably smaller in diameter than the upper end portion of the abutment member 21 and in practice it is desirable to provide the exterior of the coupler with wickers

4

39 or the like so that it can be gripped by a fishing tool should that become necessary.

The actuating means 12 is located below the slip mechanism or at the lower end portion of the structure and involves, primarily, a single cylinder 40 and a single piston 41 which operates in the cylinder. The piston also serves as the part or carrier to which the slip links 13 connect.

The cylinder 40 is a simple, straight, tubular part arranged concentric with the body 10 and surrounding it, the cylinder being somewhat larger in diameter than the body so that there is a chamber or cylinder opening A between the interior of the cylinder and the exterior of the body. The upper end of the cylinder is open or unrestricted and admits the piston 41 into the cylinder opening A. At the lower end portion, or beyond the lower end portion, of the cylinder 40 there is a coupler 43 which is joined to the lower end of the cylinder by a downwardly and inwardly converging neck 44. The coupler 43 is considerably smaller in diameter than the cylinder 40 and its upper end portion is internally threaded at 45 to receive the lower end of the body 10 while its lower end portion is internally threaded at 46 to receive the upper end portion of tubing section T'. In practice I prefer to form the cylinder 41, the neck 44 and the coupler 43 as a single integral or continuous body so that this portion of the structure is free of joints or connections.

One or more fluid passages or ports 50 are provided in the body 10, preferably opposite the neck 44 that joins the cylinder 40 and coupler 43, so that the interior of the body is in free communication with the cylinder chamber A.

The piston 41 is a simple straight element having its exterior 55 turned to slidably fit into the cylinder 40 and having a central bore 56 concentric with the exterior 55 to slidably pass the body 10. In practice I may provide one or more sealing rings 60 at the exterior of the piston to seal with the cylinder 40, and one or more sealing rings 61 at the bore of the piston to seal with the body 10. By forming the piston in the manner just described I provide a simple, annular member which is effectively guided so that it works freely longitudinally of the structure and can be readily moved upward or toward the slip mechanism by means of fluid pressure introduced to the cylinder chamber A through the ports 50. It is to be observed that through the construction that I have provided the single piston being of substantial diameter presents a large face to be acted upon by fluid admitted to the chamber A.

The piston 41 is related to the cylinder 40 so that its upper end projects somewhat above the upper end of the cylinder when the piston is in its lowermost position. The slip links 13 connect to the upper end of the piston 41. In the particular construction illustrated the upper end portion 57 of the piston is enlarged somewhat and is provided with recesses 58 which receive the lower ends of the links 13 and pivot pins 59 pivotally retain the links in the recesses. The links project upwardly from the piston to the lower ends of the slips 23 where they extend between spaced lugs 64 and are retained by pivot pins 65.

The spring 14 serves to normally yieldingly hold the working parts, that is, the piston, links and slips in a down or retracted position to which position they are normally moved through the action of gravity. The spring, in accordance with my improved construction, is a helical spring surrounding the body 10 and occurring between

5

the lower end 80 of the abutment member 21 and the upper end portion of the piston 41. The construction that I have provided makes it possible to make the anchor short compared to other devices of this general character and where the upper end of the piston 41 closely approaches the lower end 80 of the abutment member it is desired to recess one of these members to accommodate the spring. In the case illustrated I have shown a recess or counterbore 81 in the upper end of the piston 41 to receive the lower end portion of the spring 14.

The construction preferably includes one or more blow out plugs 15 which are such as to allow escape of fluid from the chamber A. In the case illustrated I have shown a number of plugs each of which involves an annular holder 70 externally threaded to be engaged in a threaded opening in the neck 44 and a displaceable slug 71 held in the holder to be displaced therefrom by a predetermined pressure occurring in the chamber A. In practice the slug 71 may be a body of soft metal cast or otherwise applied to the holder.

The structure that I have provided may, as I have indicated above, be handled or manipulated in any desired manner. For instance, it may be used or run in the manner set forth in my above-mentioned issued patent, or it can be run in any other suitable manner. Fundamentally, the construction that I have provided is such that the anchor can be run through the casing to any desired position therein during which time the parts are held retracted or in the unactuated position by the spring 14. When it is desired to set the slip mechanism fluid pressure applied to the tubing passes through the ports 50 to the chamber A to there act upon the single annular piston 41. Pressure on the bottom end of the piston overcomes the resistance of the spring 14 and the weight of the parts connected to the piston, and causes the piston to move upwardly in the cylinder 40 with the result that the slips are uniformly moved up on the faces 22 until they have moved out to a position where they engage and grip the inner wall 26 of the casing C. If for any reason the fluid cannot be drained below the anchor then pressure can be applied as by means of a pump applied at the surface and the plugs 15 can be blown out and the fluid drained from the tubing releasing the tool. A unique feature of the general construction that I have provided is the arrangement of parts whereby the slips move up in order to be forced out into gripping engagement so that when pressure is relieved from the tubing it is a simple matter to release the anchor by simply pulling up on the tubing.

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 for anchoring a string of well tubing in a well including, a tubular body conducting fluid handled by the tubing, gripping means carried by the body having an abutment with faces extending downwardly and inwardly and carrying slips, and operating means for the slips including a single cylinder surrounding the body, a piston between and slidably engaging both the cylinder and body, and links pivotally con-

6

nected to the piston and to the slips, there being a port in the body admitting fluid from within the body to the cylinder to operate the piston.

2. A tubing anchor for anchoring a string of well tubing in a well including, a tubular body, gripping means carried by the upper end portion of the body having an abutment with faces extending downwardly and inwardly and carrying slips, and operating means for the slips below the gripping means and including a single upwardly opening cylinder surrounding the body, a piston between and slidably engaged with both the cylinder and body with its upper end projecting from the cylinder, and links connected to the projecting upper end of the piston and with the slips, there being a port in the body admitting fluid from within the body to the cylinder to operate the piston.

3. A tubing anchor for anchoring a string of well tubing in a well including, a tubular body, gripping means carried by the body having an abutment with faces extending downwardly and inwardly and carrying slips, and operating means for the slips including a single cylinder surrounding the body and a piston slidable between the cylinder and body and connected with the slips, the body being a straight tube of uniform diameter extending from one end of the anchor to the other and adapted for connection with the tubing to form a continuation thereof and to pass material and objects passed by the tubing.

4. A tubing anchor for anchoring a string of well tubing in a well including, a tubular body, gripping means carried by the body having an abutment with faces extending downwardly and inwardly and carrying slips, and operating means for the slips including a single cylinder surrounding the body and a piston between and slidably engaging both the cylinder and body and connected with the slips, the abutment and the cylinder each having a coupler part to which the body is joined and forming a tubing coupling, the body having a port admitting pressure from the interior of the body to the cylinder.

5. A tubing anchor for anchoring a string of well tubing in a well including, a tubular body, gripping means carried by the upper end portion of the body having an abutment with faces extending downwardly and inwardly and carrying slips, and operating means for the slips below the gripping means and including a single cylinder surrounding the body and a piston slidable between the cylinder and body and connected with the slips, the body being a straight tube of uniform diameter extending from one end of the anchor to the other forming a continuation of the tubing connecting parts thereof, the abutment and the cylinder each having a coupler part to which the body is joined and which has a tubing receiving thread.

6. A tubing anchor for anchoring a string of well tubing in a well including, a tubular body, gripping means carried by the body having an abutment with faces extending downwardly and inwardly and carrying slips, and operating means for the slips including a single cylinder surrounding the body and a piston slidable between the cylinder and body and links pivotally connected to the piston and pivotally connected with the slips.

7. A tubing anchor for anchoring a string of well tubing in a well including, a tubular body, gripping means carried by the body having an abutment with faces extending downwardly and inwardly and carrying slips, operating means for

7

the slips including a single cylinder surrounding the body and a piston slidable between the cylinder and body and connected with the slips, and means to relieve pressure from the cylinder when it exceeds a predetermined value.

8. A tubing anchor for anchoring a string of well tubing in a well including, a tubular body, gripping means carried by the body having an abutment with faces extending downwardly and inwardly and carrying slips, operating means for the slips including a single cylinder surrounding the body and a piston slidable between the cylinder and body connected with the slips, and a spring surrounding the body and engaging the lower end of the abutment and the piston acting to yieldingly hold the piston down.

9. A tubing anchor for anchoring a string of well tubing in a well including, a tubular body, gripping means carried by the body having an abutment with faces extending downwardly and inwardly and carrying slips, operating means for the slips including a single cylinder surrounding the body and a piston slidable between the cylinder and body connected with the slips, and a spring surrounding the body and engaging the lower end of the abutment and the piston acting to yieldingly hold the piston down, the piston having a counterbore receiving the spring.

10. A tubing anchor for anchoring a string of oil well tubing in a well including, a tubular body, gripping means carried by the body having an abutment with faces extending downwardly and inwardly and carrying slips, and operating means for the slips including a single cylinder surrounding the body and a piston slidably engaged between the cylinder and body and connected with the slips, the abutment and the cylinder each having an internally threaded coupler part into which the body is threaded and to receive a tubing part, the body having a port admitting pressure from the interior of the body to the cylinder.

11. In combination, a well tubing, and an anchor for the tubing including a tubular body coupled at its ends to the tubing and having a straight uniform continuous opening extending from one end of the anchor to the other and corresponding in size to the opening of the tubing to pass material and equipment passed by the tubing, gripping means carried by the body hav-

8

ing an abutment with faces extending downwardly and inwardly and carrying slips, and operating means for the slips including a single cylinder surrounding the body and a piston slidable between the cylinder and body and connected with the slips.

12. A tubing anchor for anchoring a string of well tubing in a well including, a tubular body, gripping means carried by the body having an abutment with faces extending downwardly and inwardly and carrying slips, operating means for the slips including a single upwardly opening cylinder surrounding the body, a piston between and slidably engaged with both the cylinder and body and projecting above the cylinder, and links connected to the projecting end of the piston and connected with the slips, the body having a port admitting fluid pressure from the body to the cylinder, and a spring surrounding the body above the piston normally yieldingly urging the piston downwardly.

13. In combination, a well tubing, and an anchor for the tubing including a tubular body coupled to the tubing and having a straight uniform continuous opening extending from one end of the anchor to the other and corresponding in size to the opening of the tubing to form a continuation thereof to pass material and objects passed by the tubing, gripping means carried by the body having an abutment with faces extending downwardly and inwardly and carrying slips, and operating means for the slips including a single cylinder surrounding the body and a piston slidable between the cylinder and body and connected with the slips, the body having a port admitting fluid pressure from the body to the cylinder.

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