

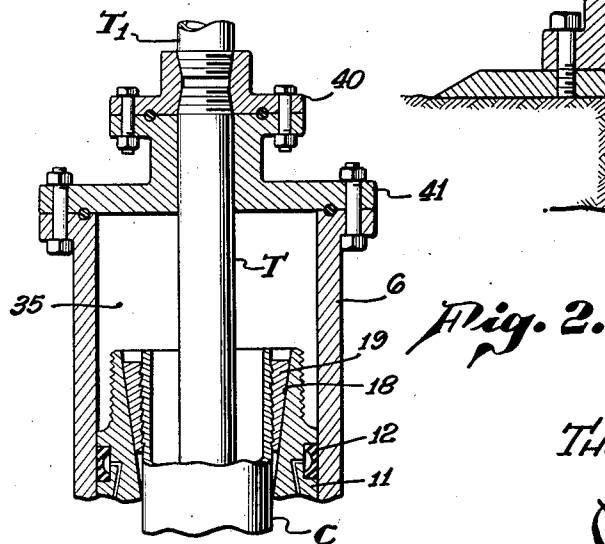
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FLOATING SUPPORT FOR WELL TUBINGS

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FLOATING SUPPORT FOR WELL TUBINGS

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This invention relates to oil wells; more particularly it relates to apparatus for supporting the well casing at the mouth of a well bore.

In an oil well, the well bore is commonly lined with a string of pipe or casing supported at its upper end as by being secured to a casing head or the like at the surface, and extending downwardly to a point above the oil strata, where, prior to the completion of the well, it is cemented to the earth formation to seal off the water sands thereabove. The casing is appropriately tensioned when so installed, by the aid of the casing head, but thereafter conditions may arise, such for example as temperature changes, or relative movement of the earth formation which cause undesirable and dangerous variations in the tension. Thus, the tension may be increased sufficiently to cause the casing to break loose at either or both of its ends, or to part at an intermediate point, or the tension may be reduced to such an extent as to cause buckling and collapse of the casing.

It is accordingly an object of this invention to provide apparatus for maintaining a casing string or the like under suitable tension throughout a predetermined range of variations in the operating conditions thereof.

It is another object of this invention to provide apparatus by the aid of which the tension in a casing string or the like may be readily altered.

It is another object of this invention to provide apparatus which will automatically operate to prevent increase of tension in a casing string or the like above a predetermined amount.

It is another object of this invention to provide apparatus affording a floating support for the well casing.

It is another object of this invention to provide apparatus for floatingly supporting the well casing, which is readily adaptable for use with different sizes of casing.

Producing oil wells usually includes a tubing string extending downwardly within the casing to the productive zone, the oil flowing upwardly through the tubing in response to gas pressure or a pump at the lower end of the tubing. Such tubing is generally supported only at its upper end, so that it is not adversely affected by temperature, formation changes, or the like. However, it may be desirable to restrict relative axial movement between such tubing and the casing. Accordingly, it is still another object of this invention to provide apparatus affording a floating support for the well tubing as well as for the casing.

This invention possesses many other advantages and has other objects which may be made more easily apparent from a consideration of several embodiments of the invention. For this purpose there are shown two forms in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed

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description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

In the accompanying drawings:

Figure 1 is an axial section, largely schematic, showing one form of the invention; and

Figure 2 is a fragmentary section, showing a modified form of the invention.

Referring to Figure 1, the apparatus comprises a vertical cylinder 6 mounted on an adapter 7 having an external flange 8 by the aid of which the cylinder 6 is supported at the mouth of the well bore in any suitable manner, as for example, by a base plate 9.

A piston structure 10 is slidable in the cylinder 6, having a head 11 sealed in fluid tight relation with cylinder wall by an expansible seal ring 12 and a reduced skirt or extension 13, passing through a bore 14 in the upper end of the adapter 7, an expansible seal ring 15 maintaining the skirt 13 and bore 14 in fluid tight relation. The piston structure 10 and the cylinder 6 thus cooperate to form an expansible chamber 16.

The piston structure 10 has a through bore 17 for freely accommodating the casing C, the upper end portion of the bore 17 being tapered to provide a seat 18 for slips 19 which engage and support the casing C. An inflatable gasket or ring 20 is provided for sealing between the piston 10 and the casing C. An important feature of this arrangement is that different sizes of casing can be readily accommodate in one apparatus by providing piston structures as 10 with suitable sized bores 17. The seal rings 12, 15 and 20 are commercially available, being made usually of artificial rubber and cooperating with the supporting member to form an annular chamber for the reception of fluid pressure to urge them to sealing condition. Thus, the rings 12 and 20 are in communication with the expansible chamber 16 by the aid of ports 21 in the piston head 11, seal ring 15 communicating with the expansible chamber 16 by the aid of ports 22-a, the main port 22, to be more fully discussed hereinafter, being connected with one of the ports 22-a.

The casing string "C" is usually anchored at its lower end to the well formation by means of a body of cement (not shown), the upper end being so supported as to maintain the casing properly tensioned. In the present apparatus, the expansible chamber 16 is filled with a fluid maintained under suitable pressure to urge the piston 10 upwardly, with such force as to properly tension the casing. For this purpose, a conduit 23 leads from the previously mentioned port 22 to a conventional source of fluid pressure 24 which may comprise a pump and by-pass arrangement, an hydraulic accumulator, or other means maintaining a suitable pressure.

A branch 25 leads from the conduit 23 to a point above the derrick floor F where it is connected to a pressure gauge 26 and to a pressure tight tank 27 provided with a conventional "water glass" or gauge 28. Brief consideration will show that with a constant amount of liquid in the system, the amount of liquid in tank 27 will be a function of the position of the piston 10 in the cylinder 5; as the piston goes down, the liquid level in tank 27 will rise, and vice versa. Accordingly, by observing the liquid level in the gauge glass 28, the position of the piston 10 can be ascertained.

Appropriate shut off valves 29 may be provided as well as a drain valve 30, and a relief valve 31 of known type for automatically releasing fluid when the pressure in the cylinder exceeds a predetermined amount.

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The tubing string T is supported on the piston structure 10 by the aid of a cap 32 threadedly secured to the piston and having a central hub 33 into which the upper end of the tubing T is threaded. Thus, the upper end of the tubing T and of the casing C move together and are maintained in fixed relationship at all times. The upper end of the cylinder 6 is closed by a detachable head 34 forming a closed chamber 35 above the piston 10 and in free communication with the interior of the casing C through one or more ports 36 in the cap 32, there being a conduit 37 leading from this chamber via port 38 for venting fluid from the chamber 35. An extension T-1 of the tubing T is threaded into the boss 33, extending through the chamber 35 and through a stuffing box 39 on the cylinder head 34.

In the form of Figure 2, the tubing string T extends through the chamber 35, and is supported independently of the piston 10 by a threaded flange 40 secured to a modified form of cylinder head 41, the cap 32 being omitted.

I claim:

1. In a floating support for a well casing, there being a tubing string within said casing: a stationary member and a relatively movable member cooperating to form an expansible chamber; said casing being secured adjacent its upper end to said movable member; means for supplying fluid pressure to said chamber to cause said movable member to at least partly support the casing; and means for supporting said tubing string independently of said movable member.

2. In a floating support for a well casing, there being a tubing string within said casing: a stationary member and a relatively movable member cooperating to form an expansible chamber; said casing being secured adjacent its upper end to said movable member; means for supplying fluid pressure to said chamber to cause said movable member to at least partly support the casing; and means for supporting said tubing on said movable member.

3. In a floating support for a well casing: a vertical cylinder structure; said casing extending upwardly into said cylinder; a piston slidable in said cylinder structure; means on the upper side of said piston for detachably connecting the upper end of said casing with the piston; a closure for the upper end of said cylinder structure forming a space therein above the piston and freely communicating with said casing; and means forming a passage connected with said space.

4. In a floating support for a well casing, there being a tubing string within said casing: a vertical cylinder structure into which said casing extends; a piston structure slidable in said cylinder structure adapted to engage the upper end of said casing in supporting relation; fluid pressure means for adjustably supporting said piston structure; and means on one of said structures above the upper end of the casing for supporting said tubing string.

5. In a floating support for a well casing, there being a tubing string within said casing: a vertical cylinder structure into which said casing extends; a piston slidable in said cylinder structure adapted to engage the upper end of said casing in supporting relation; fluid pressure means for adjustably supporting said piston; and means on said cylindrical structure above the piston for supporting said tubing string.

6. In a floating support for a well casing there being a tubing string within said casing: a vertical cylinder structure into which said casing extends; a piston slidable in said cylinder structure adapted to engage the upper end of said casing in supporting relation; fluid pressure means for adjustably supporting said piston; and means for supporting said tubing string for movement with said casing.

7. In a floating support for a well casing, there being a tubing string within said casing: a vertical cylinder structure into which said casing extends; a piston slidable

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in said cylinder structure adapted to engage the upper end of the casing in supporting relation; a closure for the upper end of said cylinder structure forming a space therein above the piston and freely communicating with said casing; means forming a passage connected with said space; and means for supplying fluid pressure to the space in said cylinder structure below the piston for operating the piston to support the casing; said tubing string extending through the space above the piston; said closure including passage forming means cooperating with said tubing to enable a connection therewith above said closure.

8. In a floating support for a well casing, there being a tubing string within said casing: a vertical cylinder structure into which said casing extends; a piston slidable in said cylinder structure adapted to engage the upper end of the casing in supporting relation; a closure for the upper end of said cylinder structure forming a space therein above the piston and freely communicating with said casing; means forming a passage connected with said space in said cylinder structure below the piston for operating the piston to support the casing; said tubing string extending through the space above the piston; and means whereby said closure is adapted to support said tubing and provides a port communicating therewith.

9. In a floating support for a well casing, there being a tubing string within said casing: a vertical cylinder structure into which said casing extends; a piston slidable in said cylinder structure adapted to engage the upper end of the casing in supporting relation; a closure for the upper end of said cylinder structure forming a space therein above the piston and freely communicating with said casing; means forming a passage connected with said space; means for supplying fluid pressure to the space in said cylinder structure below the piston for operating the piston to support the casing; and means on said piston for supporting said tubing string; said tubing string having an extension passing upwardly through the space above the piston and slidably through an opening in said closure.

10. In a support for a well casing having a tubing string therein; a cylinder structure adapted to receive the casing and the tubing string; a piston structure slidable in said cylinder structure; means for suspending the casing from said piston structure; fluid pressure means for adjustably supporting said piston structure while the latter supports said casing; and means on one of said structures for supporting said tubing string.

11. In a floating support for a well casing: a vertical cylinder structure; a piston structure slidable therein having a head engaging the cylinder wall and a tubular skirt extending downwardly through the bottom cylinder head; said piston structure having a through bore for slidably accommodating the casing; the upper end portion of said bore being enlarged and tapered to provide a slip seat accessible through the upper end of said cylinder structure; and slips on said seat for engaging the casing in supporting relation.

12. In a support for oil well casing: a stationary member; a relatively movable member; means for securing said casing for support by said movable member whereby upward movement of said member tensions said casing; means for supporting said movable member in adjusted vertical relation on the stationary member to vary the tension of said casing; and means responsive to tension in the casing in excess of a predetermined tension and connected with said stationary member at a point below the lowermost position attained by said movable member for controlling the movement of said movable member from all vertically adjusted positions of said movable member in accordance with the tension in said casing.

13. In a support for a well casing, a stationary member; a movable member operatively associated with said stationary member; means for suspending said casing

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from said movable member so that the load on the casing is continuously applied to said movable member; means for supporting said movable member in adjusted relation on said stationary member to vary the load on said casing; and means operatively connected with said stationary member at a point below the lowermost position attained by said movable member operable responsive to a load on said casing in excess of a predetermined load for relieving the excess load and controlling the movement of said movable member from all positions in which the movable member is supported by said supporting means.

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