April 14, 1959 J. S. PAGE, JR 2,881,841

HYDRAULICALLY BOOSTED ANCHOR FOR WELLS

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FIG. 1.

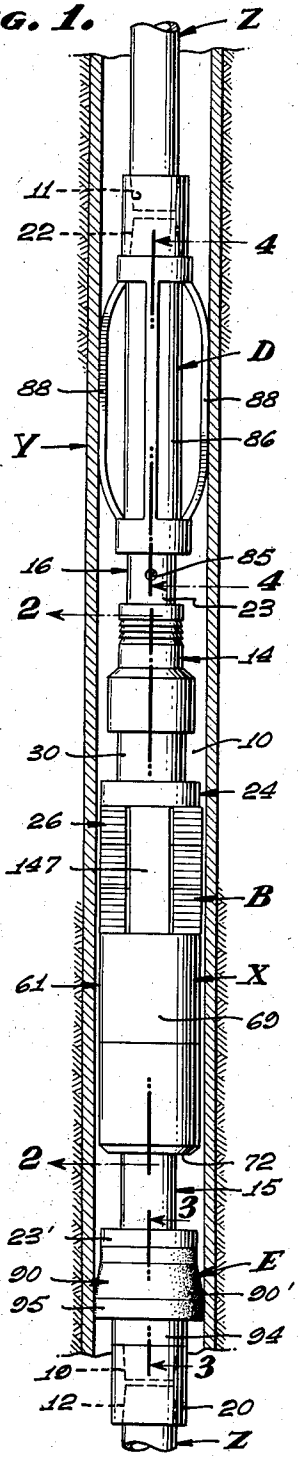
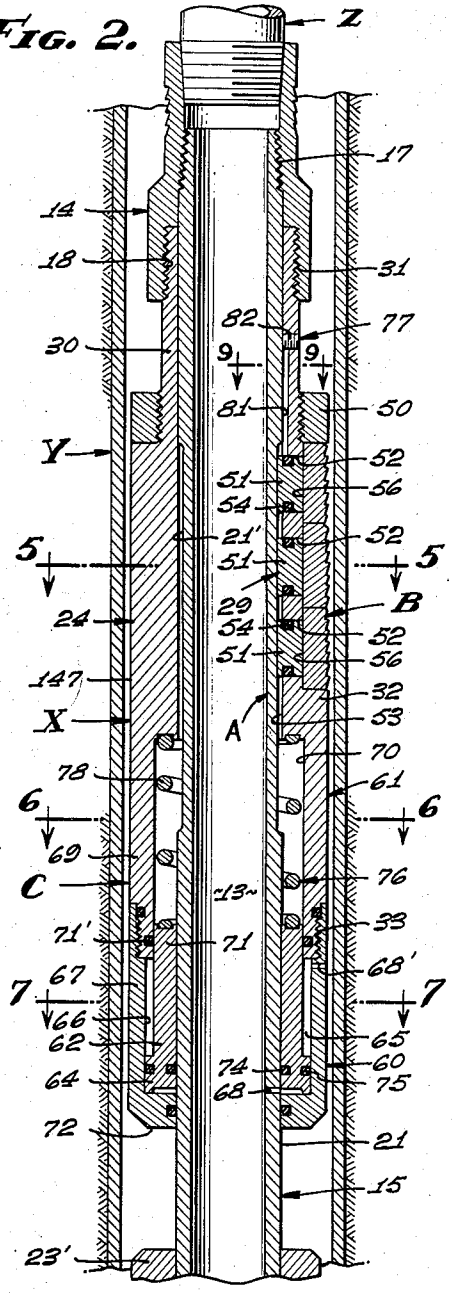


FIG. 2.



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FIG. 3.

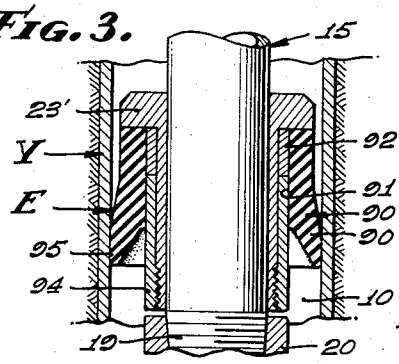


FIG. 4.

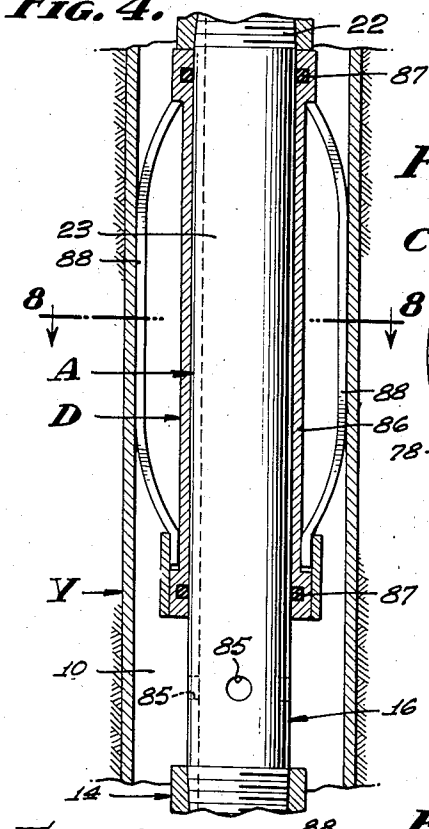


FIG. 5.

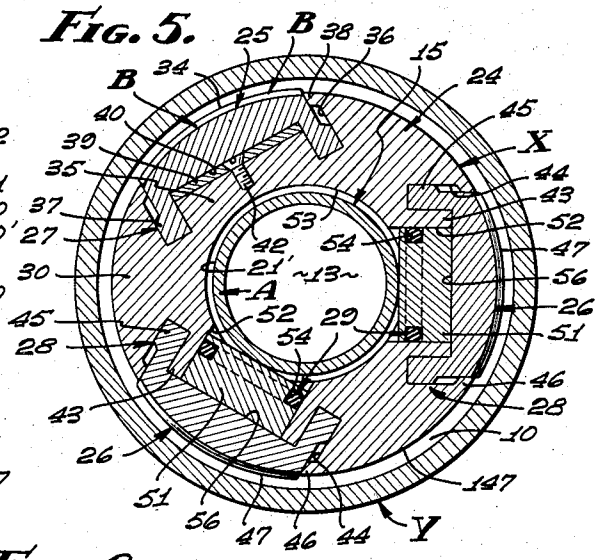


FIG. 6.

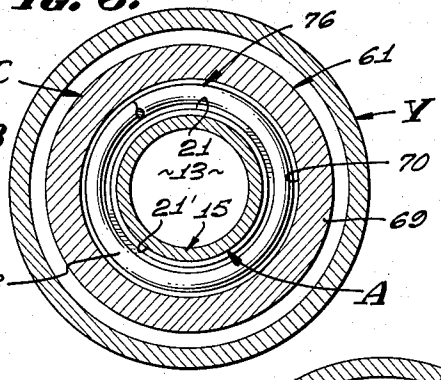


FIG. 7.

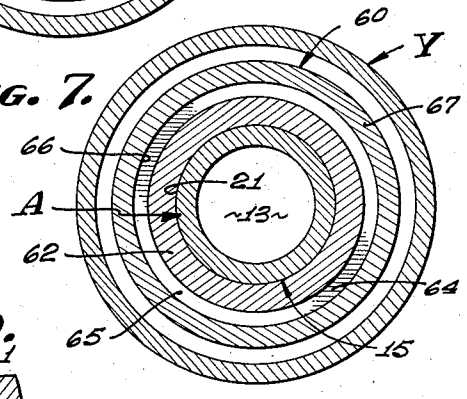


FIG. 8.

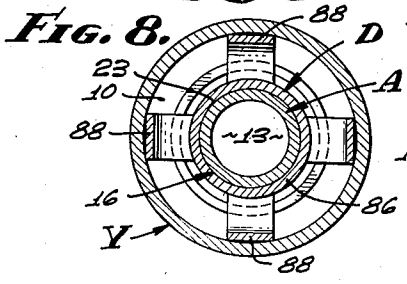
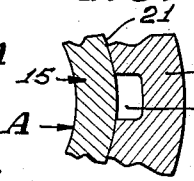


FIG. 9.



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2,881,841

HYDRAULICALLY BOOSTED ANCHOR FOR WELLS

John S. Page, Jr., Long Beach, Calif., assignor to Page Oil Tools, Inc., Long Beach, Calif., a corporation of California

Application July 6, 1954, Serial No. 441,280

8 Claims. (Cl. 166—212)

This invention has to do with a well tool and is particularly concerned with a tubing anchor employed in a well casing to facilitate various operations such as cementing, acidizing or pumping, or the like. It is a general object of the invention to provide apparatus of this general character which is of simple, practical, economic construction and which is dependable and effective in action. This application is co-pending with my application entitled, "Hydraulic Tubing Anchor For Wells," Serial No. 441,528 filed on even date herewith.

It is not uncommon in the operation of a well to employ a string tubing within a well casing and to pump fluid from or into the well as, for instance, from or into the lower end portion of the casing. Such pumping or cementing operations involve the handling of fluids at high pressure and at variations in pressure, all of which make it highly advantageous that the lower end portion of the tubing employed in carrying out such an operation be anchored or secured in the casing against undesirable movement or shifting therein.

It is an object of this invention to provide an anchor for handling tubing in a well whereby the lower end portion of the tubing is established in gripping engagement with the casing of the well so that it does not move or shift therein.

It is another object of this invention to provide apparatus of the general character referred to wherein a gripping mechanism is provided in or carried by the tubing in combination with a fluid control valve and a packer, which gripping mechanism is adapted to be actuated by increased fluid pressure to grip the casing in which the tubing is located.

It is another object of this invention to provide an anchor of the general character referred to which is characterized by a simple, practical, improved means for operating a hydraulic gripping mechanism at a fluid pressure greater than the fluid pressure in or surrounding the tool. With the construction of the present invention the affected area of the unit operated upon by fluid within the well tubing is greater than the effective area of the unit supplying fluid under pressure to the gripping means of the tool.

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 my invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a vertical sectional view through a typical well, showing the casing and showing the anchor of the present invention as it is when being lowered into the well. Fig. 2 is an enlarged detailed sectional view taken as indicated by line 2—2 on Fig. 1. Fig. 3 is an enlarged detailed sectional view taken as indicated by line 3—3 on Fig. 1. Fig. 4 is an enlarged detailed sectional view taken as indicated by line 4—4 on Fig. 1. Fig. 5 is an enlarged detailed transverse sectional view taken as indicated by line 5—5 on Fig. 2. Figs. 6 and 7 are enlarged detailed transverse sectional views taken as indicated by lines

6—6 and 7—7 on Fig. 2. Fig. 8 is a transverse sectional view taken as indicated by line 8—8 on Fig. 4, and Fig. 9 is an enlarged detailed portion of the structure taken as indicated by line 9—9 on Fig. 2.

The anchor X of the present invention is adapted to be operated in a well casing Y, which may be set or fixed in a well. A tubing Z is provided within the casing and extends downwardly therein to the desired depth to carry well equipment such as a pump or the like. In accordance with the present invention the tubing Z is considerably smaller in size than the casing Y with the result that there is an open space or annulus 10 between the casing and the tubing. In practice, the anchor X is carried by the tubing Y and may be inserted in or connected to the tubing as shown in Fig. 1 of the drawings. In accordance with well construction the upper end of the anchor X is internally threaded at 11 and is threaded onto the lower end of the upper section of the tubing Z, while the lower end of the anchor X is externally threaded at 12 and is threaded into the upper end of a section of the lower section of the tubing Z.

The hydraulic tubing anchor X of the present invention involves, generally, a frame A threaded at 11 and 12 as above described, and adapted to be inserted in a string of tubing Z, a gripping means B carried on the frame A preferably at the center portion thereof and adapted to have anchoring engagement with the casing Y, pressure boosting means C carried on the frame A preferably at the lower end thereof and adapted to increase hydraulic pressure which is used to operate the gripping means B, a valve D carried on the frame A preferably at the upper end thereof and adapted to bypass fluid through the anchor X when the valve is open and to stop flow of fluid through the anchor X when the valve is closed so that the means C is operated, and a packer E carried by the frame A above the valve D.

The frame A is an elongate tubular element that is round in cross section and is characterized by a flow passage 13 extending continuously therethrough from the top to the bottom thereof. As shown in the drawings, the frame A may be sectional and involves an upper valve section 16, a coupling section 14 and a lower section 15. The valve section 16 is provided at the upper end of the frame A and carries the threaded portion 11 above referred to. Section 14 is threadedly engaged to the lower end of section 16 and has a downwardly opening threaded bore 17 and a downwardly opening threaded counterbore 18. The bore 17 threadedly receives the upper end of the lower section 15, while the counterbore 18 threadedly receives the upper end of the means B hereinafter described.

The upper portion of the lower section 15 is screw threaded into the bore 17 and is an elongate part that depends from the coupling section and carries the gripping means B and the pressure boosting means C. As shown, an abutment member 23' is supported at the lower end portion of the section 15 to carry the packer E hereinafter described and the lower end portion is threaded at 19 and receives a coupling 20 which joins the tool to the lower section of tubing Z. The section 15 is characterized by a smooth cylindrical outer wall 21 which extends between the threaded upper and lower end portions of the section. In the preferred form of the invention the wall 21 has a portion 21' of reduced diameter which receives or accommodates elements of the means B and provides for fluid passage.

The upper valve section 16 has a threaded upper end portion 22 screwed into a coupling that joins the tool to the upper section of the tubing Z, and a lower end portion that threads into the coupling section 14. The section 16 is characterized by a smooth cylindrical outer

wall 23 which extends between the threaded upper and lower end portions of the section.

The gripping means B provided by the present invention involves, generally, an elongate tubular body 24, a plurality of shoes preferably including an abutment shoe 25, and a plurality of working shoes 26, mounting means 27 mounting the abutment shoe in a fixed position on the body, mounting means 28 mounting the working shoes on the body for movement radially relative thereto, and operating means 29 acting to move the working shoes radially into engagement with the casing Y.

The body 24 of the means B is in the form of a sleeve 30 slidably engaged on the cylindrical outer wall 21 of the frame section 15. The body 24 has a threaded upper end portion 31 screw threaded into the counterbore 18, and an enlargement 32 at its lower end and adapted to be joined or coupled to the means C hereinafter described.

The abutment shoe 25 is carried on the exterior of the body 24, that is, on the exterior of the sleeve 30 of the body, and, in accordance with the invention, it has a predetermined or fixed working position relative to the body so that it forms an abutment member engageable with the casing to provide a rigid or unyielding support establishing the body of the anchor in the casing against movement or shifting relative thereto. In the preferred form of the invention the outer face 34 of the abutment shoe 25 is convex and is preferably finished or provided with teeth to have effective gripping engagement with the wall of the case Y. The abutment shoe may, in practice, be made as an integral part or projection on the body 24. However, it is preferred that it be joined to or mounted on the body by the mounting means 27 as shown in the drawings.

The particular mounting means 27 illustrated in the drawings, involves a longitudinally disposed portion 35 on the exterior of the sleeve 30, which is provided with a longitudinal guideway 36 with opposed walls. The abutment shoe is carried in the guideway and has a widened or enlarged base portion 37 engaged between the opposing walls of the guideway. Inwardly turned or projecting flanges 38 are provided at the outer part of the guideway to overhang or overlie the enlarged base portion 37 so that the shoe cannot become radially displaced from the guideway.

In accordance with the present invention it is preferred that the abutment shoe 25 have a fixed or predetermined working position relative to the body, that is, that it have a working position from which it will not move or shift when the anchor is in use. In the particular case illustrated, the structure is such that the abutment shoe may move radially outward but it cannot move inward of the body from the predetermined working position.

The invention provides means for adjusting or varying the working position of the abutment shoe so that the shoe can be set to operate at a predetermined distance from the center of the anchor. In the form of the invention illustrated, an insert or liner 39 is provided behind the shoe or between the back 40 of the shoe and the bottom 41 of the guideway. The liner is shown secured in position by screw fasteners 42. It will be apparent from the drawings how the liner or insert 39 positively determines the working position of the abutment shoe 25, and it will be apparent that by varying liners, that is, by using liners of different thicknesses the effective position of the shoe may be varied.

In the preferred form of the invention I provide two working shoes 26 circumferentially spaced apart and from the abutment shoe 25. The several shoes 25 and 26 are preferably equally spaced around the body as illustrated in the drawings.

Each working shoe 26 is provided with a mounting means 28 by which it is mounted on the body 24 and, in the preferred form of the invention, each mounting means 28 involves a laterally disposed portion 43 on the exterior of the sleeve 30, which has a longitudinal guideway 44 with opposed guide faces. The shoe carried by the guideway has an enlarged base portion 45 that slides in the guideway 44 and inwardly projecting flanges 46 are provided at the outer part of the guideway to overlie the base portion 45 to positively prevent radial displacement of the shoe from the guideway. The shoe carried in the guideway has a convex outer face 47 preferably finished or provided with gripping teeth or the like, and the structure is such that when the shoe is retracted its outer face is substantially concentric with the outer face 147 of the portion 43 and when the shoe is extended its outer face is beyond the said portion and fits in or conforms to the contour of the interior of the casing Y.

In accordance with the present invention there may be a plurality of shoes 25 and 26 carried in the guideways 36 and 44 respectively. As shown, the shoes are retained in the guideways by the enlargement 32 at the lower end of the body 24 and by a collar 50 threaded onto the upper end of the body 24. The enlargement and the collar are provided to close the ends of the guideways to retain the shoes therein.

The operating means 29 is actuated by fluid pressure from within the body 24 and acts to operate the working shoes radially of the body and into pressure engagement with the interior of the casing Y, while the abutment shoe 25 bears in the casing and forms a fixed point positioning the body in a predetermined manner in the casing. Where there is a plurality of working shoes or where the working shoes are sectional, as above described, it is preferred that there be a unit of the operating means 29 for actuating each shoe section. In the drawings a plunger 51 is shown for operating each shoe or section and is carried in a radial cylinder opening 52 provided in the body 24, the opening extending from the interior or bore 53 of the body to the exterior of the enlargement 32 at the bottom of the guideway carrying the shoe or section thereof. A suitable packing ring or seal 54 is provided to seal the plunger in the cylinder opening, while the outer end of the plunger seats against or bears on the inner or back face 56 of the shoe section. With this construction, which is clearly illustrated in the drawings, it will be apparent that fluid pressure in the body 24 actuates the plunger outwardly so that the sections of the working shoes are individually operated outward and into suitable pressure engagement with the casing.

The pressure boosting means C is a fluid pressure operated means that supplies increased fluid pressure to the gripping means B above described and involves, generally, a fluid pressure actuated unit 60 of large effective cross sectional area and a fluid pressure generating unit 61 of reduced effective cross sectional area.

In accordance with the present invention the unit 60 is a cylinder and piston unit that operates under influence of fluid pressure, preferably under the influence of fluid pressure from within the tubing Z and includes, a tubular piston sleeve 62 slidably carried on the lower end of the frame section 15, and a drive piston 64 carried on the sleeve. The drive piston 64 is an annular element that operates in an annulus 65 formed between the outer wall 21 of the frame section 15 and the inner wall 66 of a cylinder sleeve 67 that is concentric with and surrounds the frame section.

As shown in the drawings, a cylinder 69 is carried on the lower end of the enlargement 32 of the means B and has a smooth bore 70 that receives a piston head 71 formed by the upper end of the sleeve 62. The cylinder 69 depends from the portion 32 and is preferably formed integrally therewith. The cylinder sleeve 67 is threadedly engaged with the lower end of the cylinder 69 at 33 and, as clearly illustrated in the drawings, the inner wall 66 of cylinder sleeve 67 is substantially larger in diameter than the bore 70 of cylinder 69 to the end that there is a substantial difference in the effective areas of the two cylinders. That is, the cross sectional area of the cylinder

sleeve 67 is substantially greater than the cross sectional area of the cylinder 69.

The fluid pressure generating unit 61 is essentially a cylinder and piston unit having a relatively small effective area so that there is an increase or a differential in pressure between the fluid pressure that acts upon the actuated unit 60 and the fluid pressure which is delivered by the fluid pressure generating unit 61.

An end wall 72 is carried at the lower end of the cylinder sleeve 67 forming a closed annular cylindrical chamber for the drive piston 64. In accordance with the invention and in the preferred form thereof where the fluid pressure from within the tubing is to be utilized to operate the drive piston, one or more ports 68 is provided in the wall 21 so that the interior or flow passage 13 through the frame A is in communication with the annulus 65 between the frame A and the cylinder sleeve 67. As shown in Fig. 2 of the drawings, the ports 68 are located below the piston 64 and above the end wall 72 so that the drive piston is moved upwardly under influence of fluid pressure. As illustrated in Fig. 2 of the drawings, a vent 68' is provided at the upper end of the cylinder sleeve 67 so that fluid may be exhausted therefrom as the unit 60 operates.

Inner and outer seals 74 and 75, such as O-rings or the like, are carried by the piston head 64 to provide sealing engagement with the section 15 of the frame A and the cylinder sleeve 67, and a seal 71', such as an O-ring or the like, is also carried by the piston head 71 to provide sealing engagement with the bore 70 of the cylinder 69. It is to be understood that suitable O-ring type seals, or the like, may be employed as shown throughout the structure as circumstances require.

In accordance with the present invention a suitable fluid handling means 77, and a return means 76 are provided for the pressure boosting means C. The return means 76 is in the form of a simple compression spring 78 acting between the enlargement 32 and the upper end of the piston head 71 to yieldingly urge the means C to a down or unactuated position. The fluid handling means 77 involves a charging passage 81 which is closed by a plug 82 or the like. The reduced portion 21' of the wall 21 conducts fluid from the means C to the cylinders of the gripping means B. The passage 81 provided for charging the means B and C with suitable hydraulic fluid opens at the exterior of the body 24 so that the cylinder 69 can be filled from the exterior of the structure.

The valve D is threadedly engaged with the frame section 14 and is connected to the tubing Z as by a suitable coupling, and is preferably a sleeve type valve adapted to be operated, that is, opened or closed, by manipulation of the tubing. In the particular case illustrated, the valve is adapted to be operated by vertical movement of reciprocation of the tubing.

The valve D involves one or more lateral ports or openings 85 provided in the frame section 16 at or near the lower end portion thereof, and further includes a sleeve 86 slidable relative to the tubular body to vary in position relative to the body between an up or open position where it is above the ports 85, and a down or closed position where it is over or covers the ports 85. In actual operation the sleeve remains relatively stationary in the well casing Y and the body of the valve or frame of the tool moves vertically to effect opening and closing of the valve.

Suitable packing means, such as annular packings 87, are carried by the sleeve at the end portion thereof and provide sealing engagement between the ends of the sleeve and the exterior of the body frame section 16. A suitable control means is provided and includes one or more casing engaging elements 88 which normally resist movement of the sleeve in the well casing. In the particular case illustrated, the members 88 are circumferentially spaced, outwardly bowed leaf springs carried by and extending between the end portions of the sleeve 86 and adapted to bear outwardly against the interior of the well casing.

With the construction just described the sleeve 86 will assume a position, such as shown in Fig. 1 of the drawings, in the course of lowering the tubing into the well casing, the upper end of the sleeve 86 being stopped against the coupling that connects the frame section 16 to the string of tubing. As the tubing is lowered the valve is moved downwardly in the casing against the resistance offered by the engagement of the leaf springs 88 due to their frictional engagement with the casing. When the casing has been lowered to the desired position or whenever it is desired to close the valve, upward movemovent of the tubing will result in relative movement between the valve body and the frame section 16 with the result that the ports 85 will be covered by the valve sleeve.

In accordance with the present invention the packer E operates in the annulus 10 and involves a tubular packer cup 90 with a cylindrical bore 91 carried on the abutment member 23' on the frame section 15. The packer cup may be of a type commonly employed in connection with well tools of the character under consideration, and is a downwardly faced flexible cup-shaped part 90' of rubber or like material, and is vulcanized to a ring 92 that seats in a recess formed in the abutment member 23'. A nut 94 is screw threaded onto the abutment 23' to retain the packer cup 90 in working position. The packer cup 90 has an outer peripheral lip 95 adapted to have sliding sealed engagement with the interior of the casing Y to the end that fluid and materials in the well casing cannot flow upward and into the well above the anchor X.

From the foregoing it will be apparent that I have provided an extremely simple and dependable anchor for use in a well casing or the like, which anchor grips the casing with increased pressure engagement. When it is desired to set or anchor the tubing Z in the casing Y, the valve D is closed by upward shifting of the tubing Z to cover the ports 85 whereupon fluid pressure builds up in the head of fluid in the tubing Z and acts upon the drive piston 64 so that the piston head 71 is forced upwardly in the cylinder 69. Because the piston head 71 has a smaller effective area than the affected area of the drive piston 64, there is a differential in pressure which results in increased fluid pressure being delivered to the plungers 51 of the means B. It is to be observed that the pressure boosting means is charged with clean fluid so that there is no harmful effect upon the plungers 51 and cylinder openings 52.

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 hydraulically operated tubing anchor for operation in a well casing and including, an elongate vertically disposed tubular frame having an unobstructed longitudinal flow passage extending therethrough and adapted to be engaged in a string of fluid handling tubing, said frame having a reduced portion intermediate its ends gripping means carried by the frame to engage the casing and including an elongate, vertically disposed body having a central, longitudinally disposed bore, said body having its upper end secured to the upper portion of the frame to be carried by and to surround the frame and a radially shiftable casing engaging shoe carried by the body, operating means actuated by fluid pressure carried by the body to shift the shoe radially into pressure engagement with the casing and including, a radially disposed opening in the body adjacent the shoe and said reduced portion of the frame and a shoe engaging plunger in the opening, and fluid pressure boosting means responsive to fluid pressure in the tubing to actuate the operating means and including, a cylinder bore in the

body concentric with and surrounding the frame, a piston sleeve between the frame and the cylinder bore, a cylinder sleeve depending from the body to surround the frame and larger in diameter than the cylinder bore, an enlarged drive piston on the lower end of the piston sleeve and engaged in said cylinder sleeve and a port in the frame for conducting fluid into said cylinder sleeve to act on the drive piston to shift the piston sleeve longitudinally in the cylinder bore, the cylinder bore being filled with fluid and being in open communication with the space between the body and the reduced portion of the frame and the opening of the operating means.

2. A hydraulically operated tubing anchor for operation in a well casing and including, an elongate vertically disposed tubular frame having an unobstructed longitudinal flow passage extending therethrough and adapted to be engaged in a string of fluid handling tubing, said frame having a reduced portion intermediate its ends gripping means carried by the frame to engage the casing and including an elongate, vertically disposed body having a central, longitudinally disposed bore, said body having its upper end secured to the upper portion of the frame to be carried by and to surround the frame and a plurality of radially shiftable casing engaging shoes carried by the body, operating means actuated by fluid pressure carried by the body to shift the shoes radially outward into pressure engagement with the casing and including, a radially disposed opening in the body adjacent each shoe and said reduced portion of the frame and a shoe engaging plunger in the opening, and fluid pressure boosting means responsive to fluid pressure in the tubing to deliver fluid under pressure to the operating means including, a cylinder bore entering the lower end of the body concentric with and surrounding the frame, a piston sleeve between the frame and the cylinder bore, a cylinder sleeve depending from the body to surround the frame and larger in diameter than the cylinder bore, an enlarged drive piston on the lower end of the piston sleeve and engaged in said cylinder bore and a port in the frame for conducting fluid into the cylinder sleeve to act on the drive piston to shift the piston sleeve longitudinally in the cylinder bore, the cylinder bore being filled with fluid and being in open communication with the space between the reduced portion of the frame and the openings of the operating means.

3. A hydraulically operated tubing anchor for operation in a well casing and including, an elongate vertically disposed tubular frame having an unobstructed longitudinal flow passage extending therethrough and adapted to be engaged in a string of fluid handling tubing, said frame having a reduced portion intermediate its ends gripping means carried by the frame to engage the casing and including an elongate vertically disposed body having a central longitudinally disposed bore, said body having its upper end secured to the upper portion of the frame to be carried by and surround the frame and a plurality of circumferentially and longitudinally spaced radially shiftable casing engaging shoes carried by the body, operating means actuated by fluid pressure carried by the body to shift the shoes radially outward into pressure engagement with the casing and including, a radially disposed opening in the body adjacent each shoe and said reduced portion of the frame and a shoe engaging plunger in the opening, and fluid pressure boosting means responsive to fluid pressure in the tubing to deliver fluid under pressure to the operating means and including, a cylinder bore entering the lower end of the body concentric with and surrounding the frame, a piston sleeve between the frame and the cylinder, a cylinder sleeve depending from the body to surround the frame and larger in diameter than the cylinder bore, an enlarged drive piston on the lower end of the piston sleeve and engaged in said cylinder bore and a port in the frame for conducting fluid into the cylinder sleeve to act on the drive piston for shifting the piston sleeve longitudinally in the cylinder bore, the cylinder bore being filled with fluid and being in open communication with the space between the reduced portion of the frame and the openings of the operating means.

4. A hydraulically operated tubing anchor for operation in a well casing and including, an elongate vertically disposed tubular frame having an unobstructed longitudinal flow passage extending therethrough and adapted to be engaged in a string of fluid handling tubing, gripping means carried by the frame to engage the casing and including an elongate vertically disposed body carried by and surrounding the frame, and a radially shiftable casing engaging shoe carried by the body, operating means actuated by fluid pressure carried by the body to shift the shoe radially outward into pressure engagement with the casing and including, a longitudinal fluid passage in the body, a radially disposed opening in the body adjacent the shoe and communicating with the passage and a plunger shiftably carried in the opening and engaging the shoe, and fluid pressure boosting means responsive to fluid pressure in the tubing to deliver fluid under pressure to the operating means and including, an elongate vertically disposed cylinder bore entering the lower end of the body and surrounding the frame and in open communication with the fluid passage of the operating means, a longitudinally shiftable piston sleeve between the frame and the cylinder bore, a cylinder sleeve depending from the body and surrounding the frame and larger in diameter than the cylinder bore, an enlarged drive piston at the lower end of the piston sleeve and engaged in the cylinder sleeve and a port in the frame for conducting fluid from within the frame into the cylinder sleeve below the drive piston to shift the drive piston and piston sleeve upwardly, the upper portion of the cylinder bore and the passage of the operating means being filled with fluid.

5. A hydraulically operated tubing anchor for operation in a well casing and including, an elongate vertically disposed tubular frame having an unobstructed longitudinal flow passage extending therethrough and adapted to be engaged in a string of fluid handling tubing, gripping means carried by the frame to engage the casing and including an elongate vertically disposed body carried by and surrounding the frame, and a plurality of radially shiftable casing engaging shoes carried by the body, operating means actuated by fluid pressure carried by the body to shift the shoes radially outward into pressure engagement with the casing and including, a longitudinal fluid passage in the body, a radially disposed opening in the body adjacent each shoe and communicating with the passage and a plunger shiftably carried in each opening and engaging the shoe, and fluid pressure boosting means responsive to fluid pressure in the tubing to deliver fluid under pressure to the operating means and including, an elongate vertically disposed cylinder bore entering the lower end of the body and surrounding the frame and in open communication with the fluid passage of the operating means, a longitudinally shiftable piston sleeve between the frame and the cylinder, a cylinder sleeve depending from the body and surrounding the frame and larger in diameter than the cylinder bore, an enlarged drive piston at the lower end of the piston sleeve and engaged in the cylinder sleeve and a port in the frame for conducting fluid from within the frame into the cylinder sleeve below the drive piston to shift the drive piston and piston sleeve upwardly, the upper portion of the cylinder bore and the passage of the operating means being filled with fluid.

6. A hydraulically operated tubing anchor for operation in a well casing and including, an elongate vertically disposed tubular frame having an unobstructed longitudinal flow passage extending therethrough and adapted to be engaged in a string of fluid handling tubing, gripping means carried by the frame to engage the casing

and including an elongate vertically disposed body carried by and surrounding the frame, and a radially shiftable casing engaging shoe carried by the body, operating means actuated by fluid pressure carried by the body to shift the shoe radially outward into pressure engagement with the casing and including, a longitudinal fluid passage in the body, a radially disposed opening in the body adjacent the shoe and communicating with the passage and a plunger shiftably carried in the opening and engaging the shoe, and fluid pressure boosting means responsive to fluid pressure in the tubing to deliver fluid under pressure to the operating means and including, an elongate vertically disposed bore entering the lower end of the body and surrounding the frame and communicating with the fluid passage of the operating means, an elongate vertically disposed cylinder depending from the body and surrounding the frame and larger in inside diameter than the bore, an elongate vertically disposed tubular sleeve slidably engaged around the frame and having a piston head at its upper end slidably engaged in the bore in the body and having an enlarged drive piston at its lower end and slidably engaged in said cylinder, and a port in the frame for conducting fluid from the central flow passage in the frame into the cylinder below the drive piston to shift the sleeve vertically and to urge the piston head on the upper end of the sleeve upwardly in the bore, the bore and the fluid passage of the operating means being filled with fluid.

7. A hydraulically operated tubing anchor for operation in a well casing and including, an elongate vertically disposed tubular frame having an unobstructed longitudinal flow passage extending therethrough and adapted to be engaged in a string of fluid handling tubing, gripping means carried by the frame to engage the casing and including an elongate vertically disposed body carried by and surrounding the frame, and a plurality of radially shiftable casing engaging shoes carried by the body, operating means actuated by fluid pressure carried by the body to shift the shoes radially outward into pressure engagement with the casing and including, a longitudinal fluid passage in the body, a radially disposed opening in the body adjacent each shoe and communicating with the passage and a plunger shiftably carried in each opening and engaging the shoe, and fluid pressure boosting means responsive to fluid pressure in the tubing to deliver fluid under pressure to the operating means and including, an elongate vertically disposed bore entering the lower end of the body and surrounding the frame and communicating with the fluid passage of the operating means, an elongate vertically disposed cylinder larger in cross sectional area than the base depending from the body and surrounding the frame, an elongate vertically disposed tubular sleeve slidably engaged around the frame and having a piston head at its upper end slidably engaged in the bore in the body and having a drive piston at its lower end and slidably engaged in said cylinder, and a port in the frame for conducting fluid from the central flow passage in the frame into the cylinder below the drive piston to shift the sleeve vertically and to urge the piston head on the upper end of the sleeve upwardly in the bore, the bore and the fluid passage of the operating means being filled with fluid.

8. A hydraulically operated tubing anchor for operation in a well casing and including, an elongate vertically disposed tubular frame having an unobstructed longitudinal flow passage extending therethrough and adapted to be engaged in a string of fluid handling tubing, gripping means carried by the frame to engage the casing and including an elongate vertically disposed body carried by and surrounding the frame, and a plurality of radially shiftable casing engaging shoes carried by the body, operating means actuated by fluid pressure carried by the body to shift the shoes radially outward into pressure engagement with the casing and including, a longitudinal fluid passage in the body, a radially disposed opening in the body adjacent each shoe and communicating with the passage and a plunger shiftably carried in each opening and engaging the shoe, and fluid pressure boosting means responsive to fluid pressure in the tubing to deliver fluid under pressure to the operating means and including, an elongate vertically disposed bore entering the lower end of the body and terminating at a flat bottom and surrounding the frame and communicating with the fluid passage of the operating means, an elongate vertically disposed cylinder larger in cross sectional area than the bore depending from the body and surrounding the frame, an elongate vertically disposed tubular sleeve slidably engaged around the frame and having a piston head at its upper end slidably engaged in the bore in the body and having a drive piston at its lower end and slidably engaged in said cylinder, and a port in the frame for conducting fluid from the central flow passage in the frame into the cylinder below the drive piston to shift the sleeve vertically and to urge the piston head on the upper end of the sleeve upwardly in the bore, the bore and the fluid passage of the operating means being filled with fluid and means normally urging the anchor to an unactuated position and including, a compression spring engaged around the frame to occur between the bottom of the bore and the piston head and normally yieldingly urging the sleeve downwardly.

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