

Oct. 1, 1957

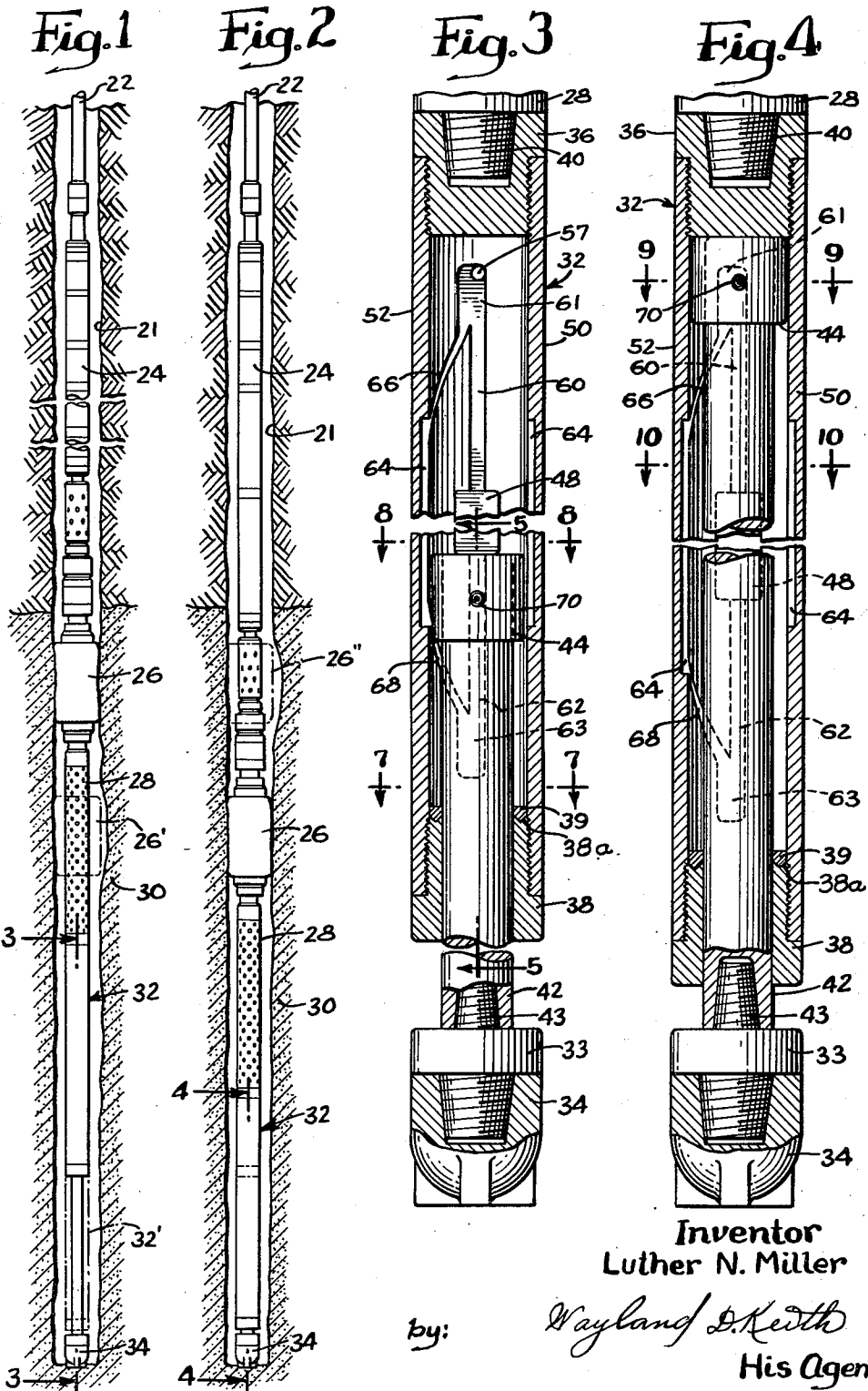
L. N. MILLER

2,808,113

LONGITUDINALLY ADJUSTABLE ANCHOR FOR WELL SERVICING TOOLS

Filed March 25, 1954

3 Sheets-Sheet 1



Oct. 1, 1957

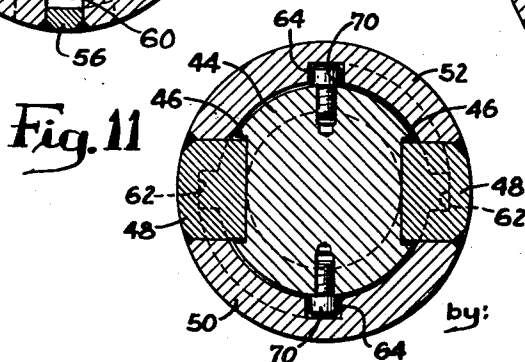
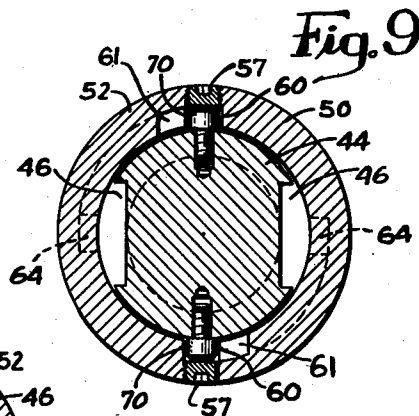
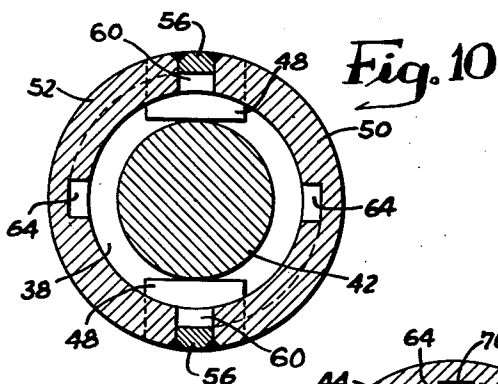
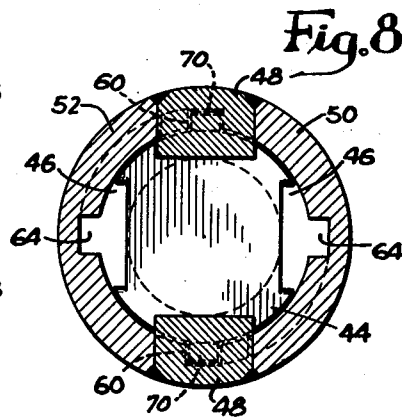
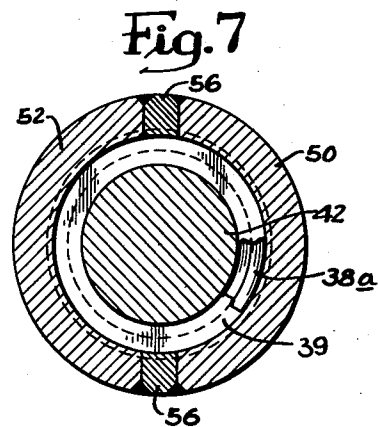
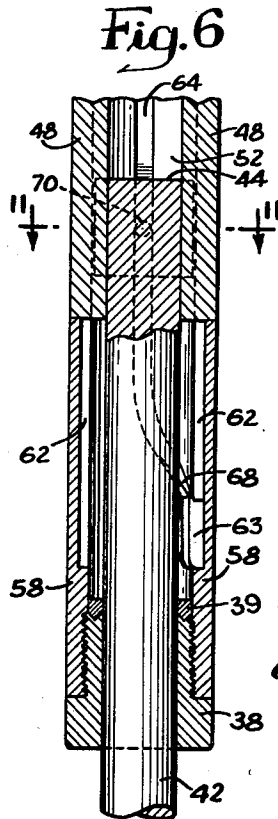
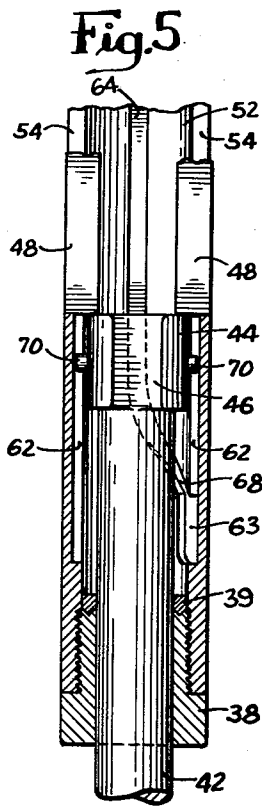
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LONGITUDINALLY ADJUSTABLE ANCHOR FOR WELL SERVICING TOOLS

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3 Sheets-Sheet 2



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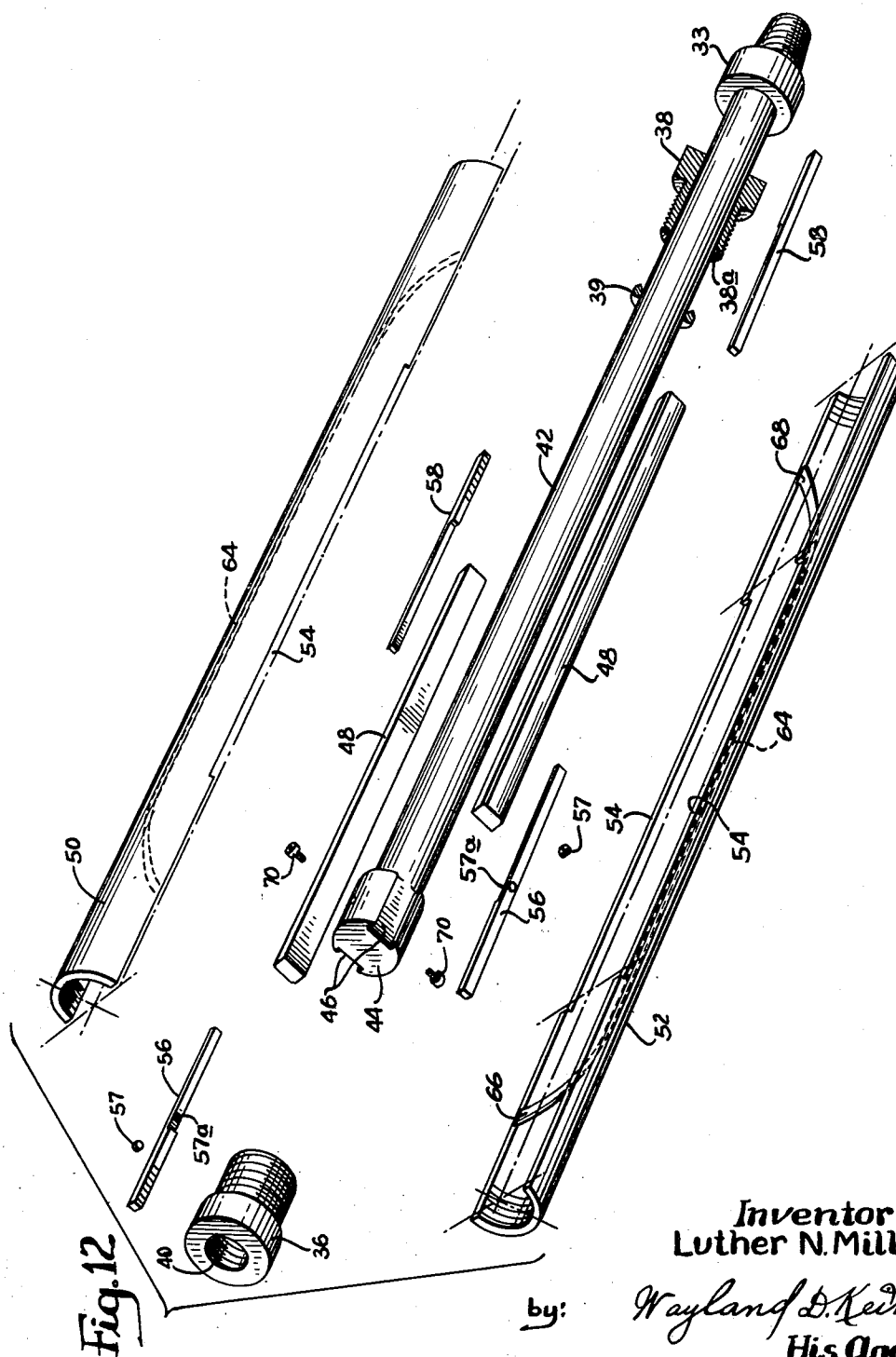
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LONGITUDINALLY ADJUSTABLE ANCHOR FOR WELL SERVICING TOOLS

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3 Sheets-Sheet 3



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2,808,113

LONGITUDINALLY ADJUSTABLE ANCHOR FOR WELL SERVICING TOOLS

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Application March 25, 1954, Serial No. 418,557

6 Claims. (Cl. 166—243)

This invention relates to well testing and well servicing mechanisms and more particularly of a mechanism or telescoping anchor that may be connected on a length of pipe or drill stem below an expanding packer so as to enable the packer to be seated at the desired point in the well and then, by manipulation of the mechanism, the packer may be raised or lowered a predetermined distance and reset without removing the packer from the well.

In the seating of packers in formation seats in a well for testing the productivity of the oil in the well, or for acidizing a well, it is often found that the packer element does not make a fluid tight seal with the formation to enable the proper testing of the formation, or to give the proper treating or servicing effect, if the packer is used to retain the acid or other formation treating fluid therebelow.

When testing wells for productivity of oil, tar or the like, it is customary to secure a length of pipe on the lower end of the packer to form an anchor to engage the bottom of the well, which anchor holds the packer a predetermined distance above the bottom of the well and defines a zone to be tested, when the packer is seated in fluid tight relation with the formation in the bore hole of the well and the test tool is opened. In event the bore hole is larger in diameter than the expanded capacity of the packer it will not seat in fluid tight relation therewith, or if certain irregularities or channels or the like exist at the point where the packer seats, the seal will not be complete and the seat will leak, which, heretofore, necessitated the withdrawal of the pipe or drill stem from the well so as to substitute an anchor of a different length, in an effort to locate the packer within the bore hole at a point where it would form a substantially fluid tight seal with the formation. It is necessary for such an anchor to withstand the weight of the drill stem thereon.

An object of this invention is to provide a tool to enable the raising or lowering of a packer or the like within the bore hole of a well to obtain a new seat, without removing the packer or the like from the well.

Another object of the invention is to provide an anchor for attachment below a packer or the like which is adjustable, and on which the entire weight of the drill stem can be placed.

Still another object of the invention is to provide an adjustable length well anchor for packers and the like, which may be constructed of complementary parts and assembled to form a unitary structure.

Another object of the invention is to provide a testing tool and an adjustable anchor that are sturdy in construction, and which are easy to install and to operate.

With these objects in mind and others that will manifest themselves as the description proceeds, reference is to be had to the accompanying drawings in which like reference characters designate like parts in the several views thereof, in which:

Fig. 1 is a longitudinal sectional view of a portion of a well showing a length of drill stem with a formation

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production tester on the lower end thereof, including a formation packer and showing an adjustable length anchor embodying the present invention, with parts broken away, and shortened, and showing the packer and anchor in full outline in raised position, and another position thereof being shown in dot-dash outline;

Fig. 2 is a view similar to Fig. 1, but showing the packer and anchor in dot-dash outline in one position and showing the packer and anchor in full outline in lowered position;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1, looking in the direction indicated by the arrows, and with parts broken away, shortened and with parts shown in elevation to bring out the details of construction, and showing the anchor in extended position;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 2, looking in the direction indicated by the arrows, with parts broken away and shortened and with parts shown in elevation to bring out the details of construction, and to show the anchor in telescoped condition;

Fig. 5 is a fragmentary longitudinal sectional view taken on the line 5—5 of Fig. 3, looking in the direction indicated by the arrows, and showing parts in elevation with the anchor extended in seated relation;

Fig. 6 is a fragmentary, longitudinal sectional view similar to Fig. 5, but showing the key-ways in the head of the anchor;

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 3, looking in the direction indicated by the arrows;

Fig. 8 is a cross sectional view taken on the line 8—8 of Fig. 3, looking in the direction indicated by the arrows;

Fig. 9 is a sectional view taken on the line 9—9 of Fig. 4, looking in the direction indicated by the arrows;

Fig. 10 is a cross sectional view taken on the line 10—10 of Fig. 4, looking in the direction indicated by the arrows;

Fig. 11 is a cross sectional view taken on the line 11—11 of Fig. 6, looking in the direction indicated by the arrows; and

Fig. 12 is an exploded, perspective view showing the various parts in disassembled relation with certain parts shown in cross section.

With more detailed reference to the drawings the numeral 21 designates a bore hole of a well having a string of drill stem 22 therein. A tool 24 is secured to the lower end of the drill stem, said tool being of a character which may be used for testing productivity of oil and gas bearing formation and the like, or the tool may be of the type for acidizing or treating oil and gas bearing formation in an effort to increase the productivity thereof. The tool 24 has a packer 26 fitted on the lower end thereof. The packer is of rubber-like material and capable of being expanded. The lower end of the packer 26 is adapted to have a perforated nipple 28 attached thereto, which perforated nipple extends the desired distance into a formation 30 which is to be tested. The lower end of the nipple 28 is adapted to threadably engage an anchor, generally designated by the numeral 32. The lower end of the anchor 32 is adapted to receive an anchor shoe 34 for engagement with the bottom of the well 21.

In testing formations to determine the productivity of the oil and gas therein, a tool, such as indicated at 24, having packer 26 thereon with perforated nipple 28 below the packer, and with a suitable length of anchor pipe below the perforated nipple, is run into the well for testing. However certain irregularities in the wall of the well frequently prevent the packer from seating, when expanded, in secure, fluid tight relation with the wall of the well, in which case mud and water from above the packer would enter the chamber formed in the bore hole of the well below the packer.

It has been the practice heretofore, to remove the entire string of drill stem 22 and the packer 26, when a perfect seal was not had, and to either put a longer or shorter anchor pipe below the perforated nipple 28, in order that the packer might be located in a different zone. With the present device, as shown in Fig. 1, the packer may be initially set as indicated in dot-dash outline at 26', but if, due to irregularities in the bore hole at that particular section, it may be necessary to raise the packer 26 to the point indicated in full outline in Fig. 1.

With the present well servicing mechanism, the packer may be raised a predetermined distance without removing the drill stem from the well, so another attempt may be made to seat the packer in fluid tight relation with the wall of the well. The well servicing mechanism provides a telescoping anchor having an upper end plug 36 and a lower end plug 38. The upper end plug 36 has a threaded box 40 to threadably receive the lower end of the perforated nipple 28, or such other connection as may be desired. The lower end plug 38 has a bore therein to slidably receive a plunger 42 therethrough. The plunger 42 has a head 44 on the upper end thereof, which head has grooves or key-ways 46 in opposite sides thereof, which key-ways are adapted to register with a pair of oppositely disposed keys 48 positioned in the body of the tool when in one position, as shown in Figs. 6 and 11, and to be at substantially right angles to said keys, when in another position, so that the head 44 will engage the keys substantially as shown in Figs. 5 and 8. The plunger 42 is screw threaded to receive a pin 43 for attachment of tool joint members 33, so as to enable assembly of the tool.

The end plugs 36 and 38 are screw threaded into a tubular member, which tubular member is assembled from several parts including a pair of substantially semi-cylindrical members 50 and 52 best shown in Fig. 12. The pair of keys, generally designated by the numeral 48 are received in slots 54, which slots are formed at the juncture of the semi-cylindrical members 50—52. Filler bars 56 and 58 are also fitted at the ends of the respective keys between the semi-cylindrical members 50 and 52, at the juncture thereof, which filler bars are of such thickness as to form longitudinal grooves 60 and 62. Each of the filler bars 56 has threaded holes 57a formed therein to receive a "blind" plug 57 (Figs. 9 and 12) to permit the insertion of screws 70 to enable the assembly of the tool. The semi-cylindrical members 50 and 52 each have an elongated, longitudinal groove 64 formed therein, which connects with transition spiral or angular grooves 66 and 68 respectively at the upper and lower ends of the respective semi-cylindrical members. These transition grooves 66 and 68 connect to the upper and lower ends of the respective grooves 60 and 62 so as to form a Y-switching arrangement.

A pair of grooves 61 and 63 extending from the grooves 60 and 62, respectively, are approximately twice the width of grooves 60 and 62, which enables the turning of the body portion of the anchor 32 sufficient to allow the switching of screw members 70 into the desired groove.

The head 44 has screws 70 screw threaded into opposite sides thereof, the heads of which screws are adapted to project outward to engage the respective grooves 60, 62, 64, 66, and 68. With the heads of the screws 70 fitted in the above mentioned grooves, the semi-cylindrical members 50—52 are welded together, as best seen in Figs. 7 through 11, so as to form a substantially tubular member, which is sufficiently tight to exclude detritus during the operation of the tool.

When the semi-cylindrical members 50—52 are welded together, and the head 44 and plunger 42 fitted therein, the head is slidable within the tubular member thus formed between the end plugs 36 and 38, which are screw threaded into the respective ends of the tubing.

The various component parts of the telescoping anchor

are fitted together and the keys and filler bars are welded in place, then the tool is ready for use.

The end plug 38 has a groove 38a (Figs. 7 and 12) formed therein in the upper face thereof which preferably has downwardly and inwardly sloping sides so as to receive thrust bearing ring 39. The lower face of the head 44 is adapted to seat in the thrust bearing ring 39 when the head is in the lower-most position, which thrust bearing ring will enable the head 44 to move within the limits of the confines of the groove 63, thereby enabling the head 44 and the heads of the screws 70 to rotate freely until the heads of the screws 70 are in alignment either with the grooves 62 or the grooves 68, to enable the proper switching of the screws 70, to obtain the proper setting of the tool.

Operation

With the telescoping anchor 32 fitted on the lower end of the formation testing device below the formation engaging packer 26, the tool is ready for testing the productivity of the fluid bearing formation. When the tool is lowered to the bottom of the bore hole 21, such as indicated in Fig. 1, the packer will be in the initial position as indicated in dot-dash outline at 26', i. e. with the plunger telescoped into the tubular member. The telescoping anchor 32 will then be in the position as indicated at 32' in dot-dash outline, whereupon the plunger 42 engages the bottom of the hole and enables the packer to be set in the well. However, if due to irregularities in the wall of the bore hole of the well 21, at this particular location, the packer 26 does not seat therein in fluid tight relation, the tool may be actuated to elevate the packer 26 into its position shown in full lines in Fig. 1, in order to seat it in the desired fluid tight relation with the walls of the bore hole 21.

With the tool in the first position, as indicated in dot-dash outline in Fig. 1, that is, with the head 44 against the lower face of plug 36, and with the weight of the drill stem 32 causing the packer 26 to expand into contact relation with the walls of the well, if the packer does not close the bore hole of the well, the drill stem 22 may be raised and at the same time turned in a clockwise direction, whereupon the heads of the screws 70 will follow down the grooves 61 as the semi-cylindrical members 50—52 move upward, thence into grooves 66 and downward in longitudinal grooves 64 into spiral grooves 68 and thence into grooves 62—63 to the bottom thereof. Whereupon, the drill stem 32 is lowered without turning. The heads of the screws 70 will move in guided relation in grooves 62, as the semi-cylindrical members 50—52 are lowered, whereupon, the keys 48 will come to rest on the top of head 44 substantially as shown in Fig. 3. The entire weight of the drill stem then comes to rest with the weight thereof being transferred through keys 48 to the head 44 and thence downward through plunger 42 to anchor shoe 34 on the bottom of the well. In this manner the packer 26 has been raised from the position as shown at 26' to the position shown at 26 in Fig. 1. The length of the movement is determined by the length of the grooves 60, 62, 64, 66 and 68. After the packer is located at a new position within the bore hole 21 and expanded into sealing relation with the walls of the bore hole of the well, the test may be made, and if the seal is complete, the removal of the packer from the well is obviated, thereby saving many hours of work which has heretofore been necessary in relocating the packer in the bore hole of a well.

It is preferable to use the telescoping anchor in this manner when acidizing or treating wells with various processes, such as fracturing the formation under hydraulic pressure and injecting granular substance therein. If the seal is complete and the lower zone is treated with acid or such other process that might fracture or eat away the seat within the bore hole of the well, the tool may be raised in the manner set forth above, a pre-

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determined distance, and the zone treated without removing the tool from the well.

In certain instances it is desirable to first try to seat the packer at an upper zone, as indicated in dot-dash outline at 26" in Fig. 2, and if the seal is incomplete the packer 26 may then be lowered to a better position. When the tool is in its extended position, as indicated in Fig. 3, and with the head 44 resting on the lower end of the keys 48, the tool may be raised until the heads of screws 70 move to the bottom of slots 63, and head 44 becomes seated on thrust bearing ring 39. The drill stem may then be rotated the width of the slots 63 in a clockwise direction, so that the heads of screws 70 will follow upward through spiral grooves 68 through longitudinal grooves 64 and thence into spiral grooves 66 and into the upper ends of grooves 60 so that the head 44 will seat upon upper plug 36, substantially as shown in Fig. 4. This will enable lowering the packer from the position as indicated in dot-dash outline at 26", in Fig. 2, to the position as indicated at 26 in full outline in Fig. 2. Whereupon, the entire weight of the drill stem, if desired, may be exerted on the packer 26 to expand the packer as the weight is transferred through telescoping anchor 32 to the bottom of the well.

In lowering the telescoping anchor into the well or removing it therefrom, when in telescoped condition, the lower shouldered portion of the head 44 rests upon the top of keys 48, which function as stops therefor. When it is desired to lower the telescoping anchor into the well or to remove it therefrom in extended position, the lower shouldered portion of head 44 rests upon the upper face of lower plug 38, therefore it will be seen that all times, either testing with the tool, or lowering it or removing it from the well, that the head is either abutting with the upper or the lower plug 36 or 38 respectively, or with the upper and lower ends of keys 48, therefore great weight can be carried by the telescoping anchor. In event the plunger 42 becomes stuck while being inserted or removed from the well, considerable strain or pressure can be applied thereto without danger of failure of the tool.

It is to be understood that the tool may be made in varying lengths to accommodate the particular operation to be performed and also it is to be pointed out that while the tool is shown to be capable of both upward and downward movement, that is, it may be either raised or lowered in the well, when in the opposite position, the tool may also be made to perform in one direction only, that is, it may be lowered only, after it is initially set, or it may be raised only after it is initially set.

While the invention has been illustrated and described in some detail in one embodiment thereof, it is to be understood that changes may be made in the minor details of construction, and adaptations made to different installations and operations without departing from the spirit of the invention or the scope of the appended claims.

Having thus clearly shown and described the invention, what is claimed as new, and desired to secure by Letters Patent is:

1. A longitudinally adjustable anchor for use on a stem or the like for positioning a well servicing tool in a well, a tubular body comprising a pair of substantially semi-cylindrical members together, means for securing said semi-cylindrical members together, a threaded connection means on an end of said body, an apertured bushing at the opposite end of said body, a plunger slidably fitted within said apertured bushing and extending into said body, a head on said plunger within said body, said body having a groove system formed thereon, which groove system comprises a longitudinal groove formed on a side of said body near one end thereof, a second longitudinal groove formed on said body substantially parallel with said first mentioned longitudinal groove and circumferentially spaced with respect thereto, an angularly disposed groove formed on said body and connecting said first mentioned longitudinal groove near the outer end thereof with said second mentioned longitudinal groove at the

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outer end thereof a spaced distance inward from the outer end of said tubular member, an outstanding projection mounted on said head and adapted to be slidably received within said groove system, a key mounted within said tubular body longitudinally thereof, a keyway formed within said head and being adapted to complementarily engage said key when said head is in one position and to complementarily disengage said key when said head is moved into another position, said head being adapted to abut with an end of said key when said head is in a certain position, said stem being adapted to turn said body relative to said head to enable the moving of said body to a different elevation with respect to the head of said plunger.

2. A longitudinally adjustable anchor for use on a stem or the like for positioning a well servicing tool in a well, a tubular body comprising a pair of substantially semi-cylindrical members together, a threaded connection means on an end of said body, an apertured bushing at the opposite end of said body, a plunger slidably fitted within said apertured bushing and extending into said body, a head on said plunger within said body, said body having a groove system formed therein, which groove system comprises a first longitudinal groove and a second longitudinal groove formed in an inner side of said body near each end thereof, a third longitudinal groove formed in said body substantially parallel with said first mentioned longitudinal grooves and circumferentially spaced with respect thereto, angularly disposed grooves formed in said body and each connecting each of said first mentioned respective longitudinal grooves near the outer end thereof with said third mentioned longitudinal groove at the outer end thereof a spaced distance inward from the outer end of said tubular member, an outstanding projection mounted on said head and adapted to be slidably received within said groove system, a key mounted within said tubular body longitudinally thereof a spaced distance from each end, a keyway formed within said head and being adapted to complementarily engage said key when said head is in one position and to complementarily disengage said key when said head is moved to another position, said head being adapted to abut with an end of said key when said head is in a certain position, and said stem being adapted to turn said body relative to said head to enable the moving of said body to a different elevation with respect to the head of said plunger and maintaining said plunger in a load bearing condition when in said position.

3. A longitudinally adjustable anchor for positioning a well servicing tool supported on a string of drill stem in a well, comprising a tubular body suspended below the tool, a plunger extending through the bottom of the body and movable longitudinally of the body, said body having a system of elongated grooves extending longitudinally thereof including a straight groove and a curved groove bypassing an intermediate portion of the straight groove, a projection formed on the plunger and mounted slidably in the grooves for guiding the longitudinal movement of the plunger, and a stop mounted in said intermediate portion of the straight groove for selectively engaging the plunger to prevent longitudinal movement of the plunger therepast, whereby the plunger may be selectively moved between opposite ends of the body by sliding the projection along the curved groove between opposite sides of the stop to thereby permit adjustment of the anchor.

4. A longitudinally adjustable anchor for positioning a well servicing tool supported on a string of drill stem in a well, comprising a tubular body suspended below the tool, a plunger extending through the bottom of the body and movable longitudinally of the body, said body having a curved longitudinal groove formed therein and having a straight longitudinal groove interconnected near opposite ends thereof with opposite ends of the curved groove, a projection formed on the plunger and mounted

slidably in said grooves for guiding the longitudinal movement of the plunger, and a stop positioned at an intermediate point in the straight groove for selectively engaging the plunger to prevent longitudinal movement of the plunger therepast, whereby the plunger may be selectively moved between opposite ends of the body by effecting relative rotary and longitudinal movement of the drill stem and the body to slide the projection along the grooves, thereby permitting adjustment of the anchor.

5. A longitudinally adjustable anchor for positioning a well servicing tool supported on a string of drill stem in a well, comprising a tubular body suspended below the tool, a plunger extending through the bottom of the body and movable longitudinally of the body, said plunger having an enlarged head formed on the upper end thereof and having a projection formed on said head, a pair of plugs mounted at opposite ends of the tubular body for providing abutments to limit the longitudinal movement of the head, said body having a system of elongated grooves extending longitudinally thereof including a straight groove and a curved groove bypassing an intermediate portion of the straight groove, the projection on the plunger being mounted slidably in the grooves for guiding the longitudinal movement of the plunger, and a stop mounted in said intermediate portion of the straight groove for selectively engaging the head to prevent longitudinal movement of the plunger therepast, whereby the plunger may be selectively moved between opposite ends of the body by sliding the projection along the curved groove between opposite sides of the stop to thereby permit adjustment of the anchor.

6. A longitudinally adjustable anchor for positioning

a well servicing tool supported on a string of drill stem in a well, comprising a tubular body suspended below the tool, a plunger extending through the bottom of the body and movable longitudinally of the body, said plunger having an enlarged head formed on the upper end thereof and having a projection formed on said head, a pair of plugs mounted at opposite ends of the tubular body for providing abutments to limit the longitudinal movement of the head, said body having a system of elongated grooves formed therein including a curved longitudinal groove bypassing an intermediate portion of a straight longitudinal groove interconnected near opposite ends thereof with opposite ends of the curved groove, the projection on the plunger being mounted slidably in the grooves for guiding the longitudinal movement of the plunger, and a stop mounted in said intermediate portion of the straight groove for selectively abutting the head to prevent longitudinal movement of the plunger therepast, whereby the plunger may be selectively moved between opposite ends of the body by effecting relative rotary and longitudinal movement of the drill stem and the body to slide the projection along the curved groove between opposite sides of the stop, thereby permitting adjustment of the anchor.

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