

March 12, 1963

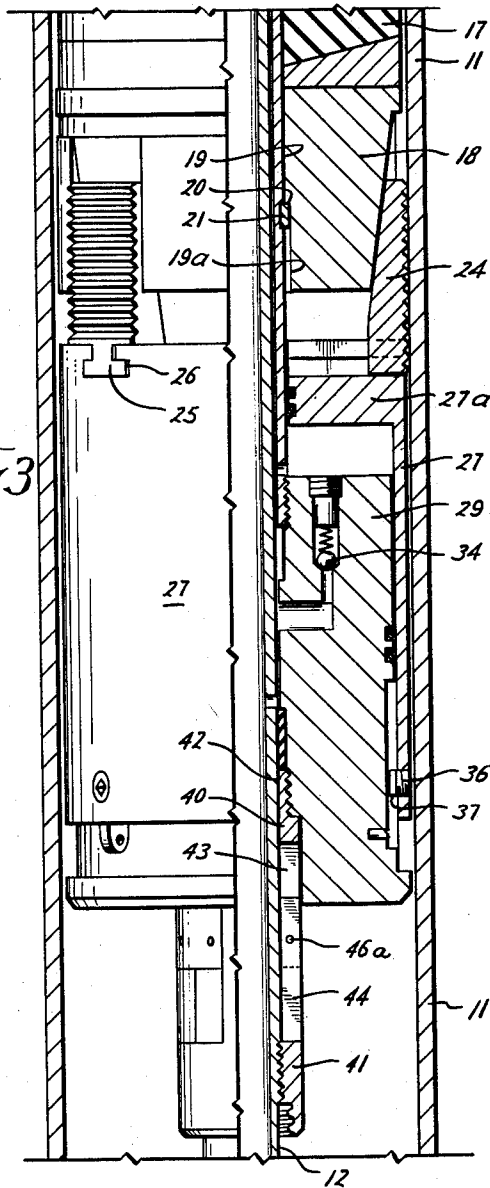
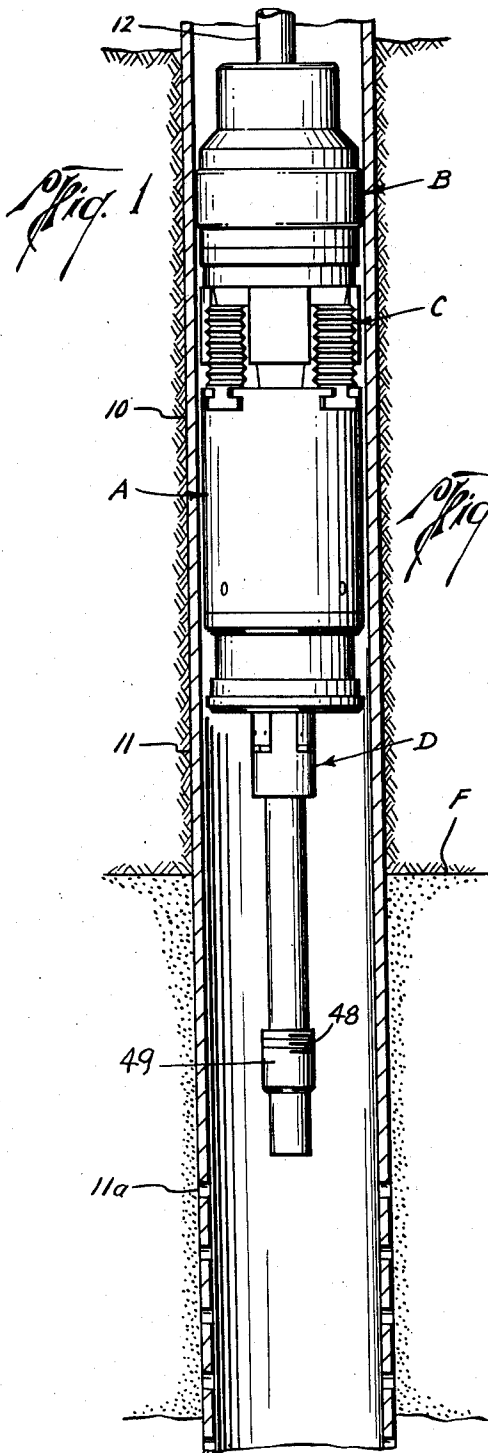
C. C. BROWN

3,080,923

HYDRAULICALLY-ACTUATED WELL PACKERS

Filed June 30, 1958

3 Sheets-Sheet 1



Cicero C. Brown
INVENTOR.

BY *Vincent Martin*
Ed E. Edwards
M. Harvey Gay
ATTORNEYS

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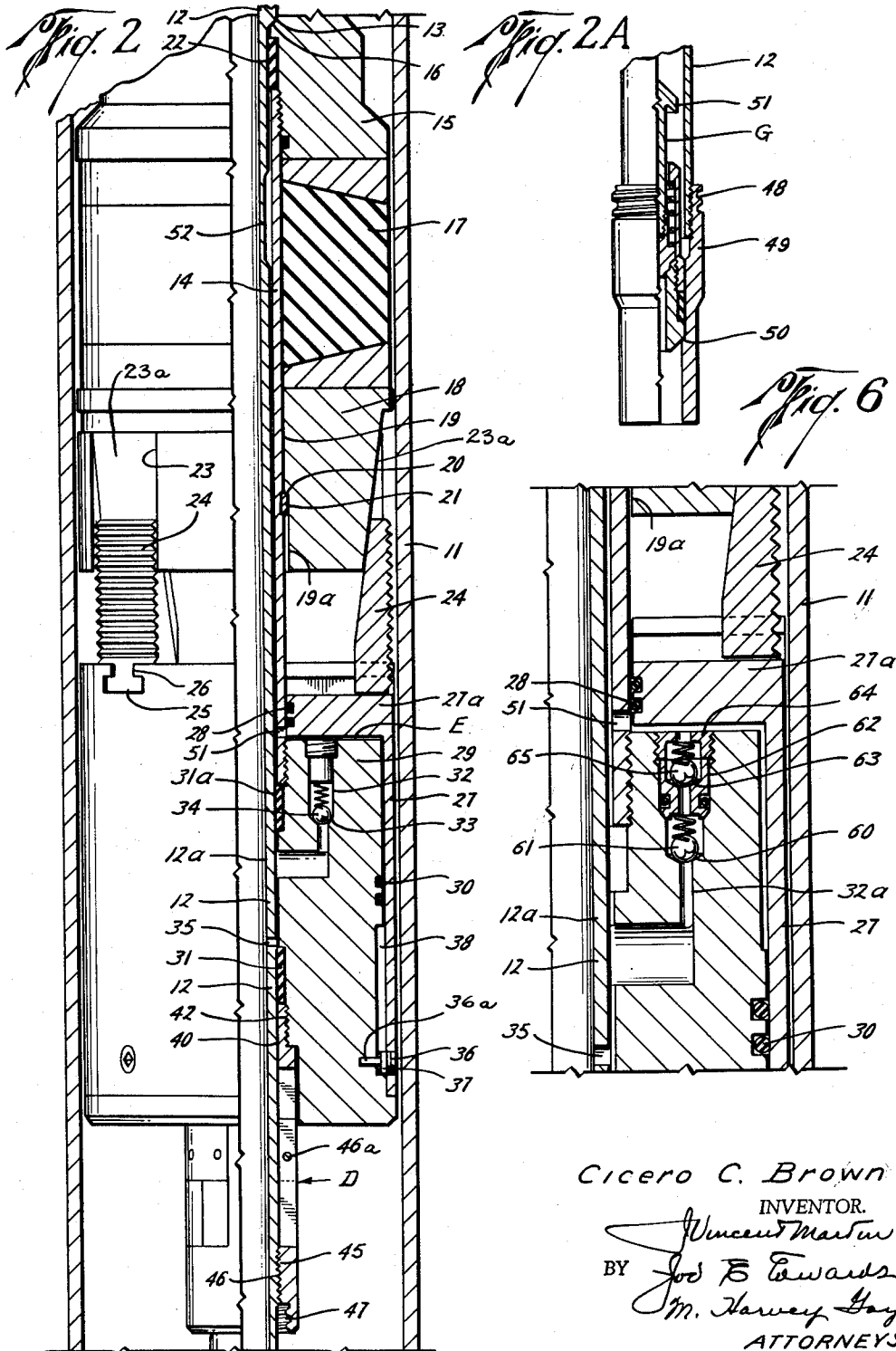
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INVENTOR.

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M. Harvey Gay
 ATTORNEYS

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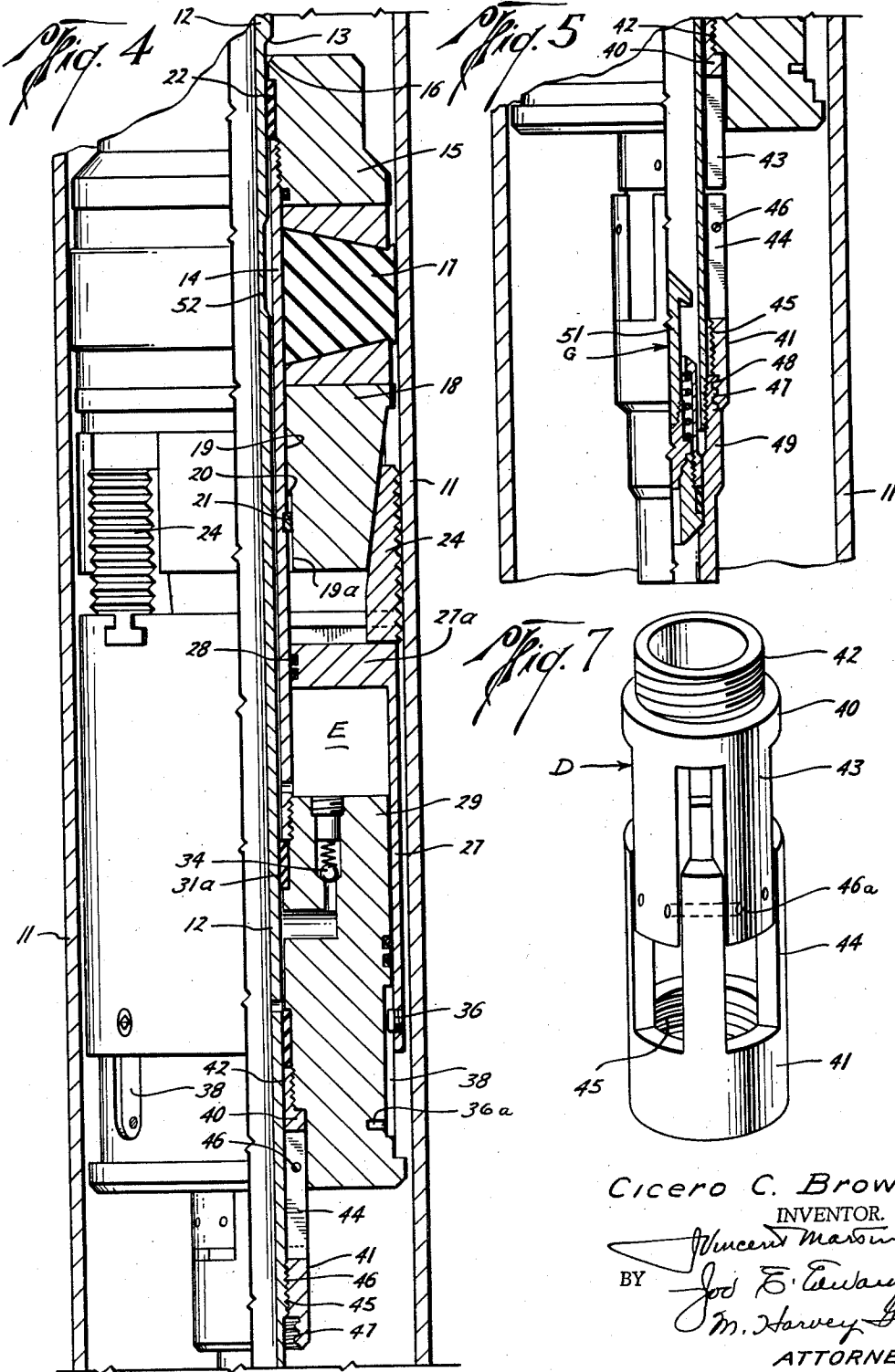
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INVENTOR.

BY *Vincent Martin*
Joe E. Edwards
M. Harvey Gay
ATTORNEYS

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HYDRAULICALLY-ACTUATED WELL PACKERS
Cicero C. Brown, Houston, Tex., assignor to Brown Oil
Tools, Inc., Houston, Tex., a corporation of Texas
Filed June 30, 1958, Ser. No. 745,550
13 Claims. (Cl. 166—120)

This invention relates to new and useful improvements in hydraulically-actuated well packers.

One object of the invention is to provide an improved well packer which may be set by hydraulic pressure and released by manipulation of the tubing string whereby the packer is particularly adaptable for use with well completion apparatus such as is illustrated in my co-pending application Serial No. 728,967 filed April 16, 1958.

An important object is to provide an improved well packer which may be lowered on a well tubing string to its desired location within the well bore after which the tubing may be landed in final position in the well head equipment prior to the setting of the packer whereby circulation of fluid around the unset packer for washing the formation or for other purposes may be effectively carried out with the well under full control; movement of the packer to set position being accomplished by hydraulic pressure which applies an endwise force to the sealing element of the packer to deform the same into sealing engagement with the wall of the well bore.

Another object is to provide a hydraulically-actuated well packer which is mounted upon a well tubing string and which is so constructed that the elastic sealing element of the packer does not sealingly engage the exterior of the tubing when the element is in sealing position, whereby frictional resistance to the longitudinal movement of the tubing string with respect to the packer assembly when the sealing element is in sealing position is minimized, which assures that said tubing may be readily rotated or otherwise moved longitudinally of the packer assembly even though the packer is in fully set position.

A further object is to provide a well packer of the character described wherein the tubing string is connected with the well packer assembly by an improved type of connection which may be released to allow longitudinal movement of the tubing to effect a release or unsetting of the packer and which may thereafter function to reconnect the tubing to the packer assembly, whereby said assembly can be removed from the well bore by means of said tubing string.

A particular object is to provide a well packer which is carried by a tubing string in which the connection between the packer assembly and the tubing includes a jarring device whereby, if necessary, the tubing may be utilized to jar upwardly on the packer assembly to assure positive release and removal of the packer by the tubing string.

The construction designed to carry out the invention will be hereinafter described, together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown, and wherein:

FIGURE 1 is an elevation of a well packer, constructed in accordance with the invention, and illustrating the packer being lowered within a well casing which is shown in section;

FIGURE 2 is a view, partly in section and partly in elevation of the well packer assembly with the packer in unset position;

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FIGURE 2a is a continuation of FIGURE 2 showing the extreme lower portion of the assembly;

FIGURE 3 is a view partly in section and partly in elevation of a portion of the well packer assembly, illustrating the gripping slips moved to set position with the packing element still in non-sealing position;

FIGURE 4 is a view similar to FIGURE 2 with the packer in fully set position;

FIGURE 5 is a view partly in section and partly in elevation showing the reconnection between the tubing string and packer assembly after the packer has been released and is to be removed from the bore;

FIGURE 6 is an enlarged detail view of one type of back check valve arrangement which may be employed in the packer assembly; and

FIGURE 7 is an isometric view of the special coupling which connects the tubing string to the well packer assembly.

In the drawings, the numeral 10 designates a well bore which traverses a producing formation F and which has the usual well casing 11 disposed therein. The casing is provided with the usual perforations 11a which are located opposite the producing formation whereby flow of well fluids from the formation may enter the lower end of the casing. The improved well packer which is constructed in accordance with the present invention is generally indicated at A in FIGURE 1 and, as will be explained, the packer is adapted to be lowered into proper position within the well casing by means of the usual tubing string 12. When the packer is in set position within the well casing, it functions to seal off the annular space between the tubing and the casing whereby the flow of well fluids is directed upwardly through the well tubing to the surface of the well.

The packer A includes an elastic packing element B and an anchoring mechanism generally indicated at C and said anchoring mechanism or means is adapted to be engaged with the wall of the well casing to lock the packer therein; the packing element B is adapted to be deformed into sealing contact with the wall of the well casing to effect a closure or sealing of the annular space. Both the anchoring mechanism and the packing element, as will be hereinafter described, are arranged to be moved into set position by the application of a hydraulic fluid pressure which fluid pressure is conducted downwardly to the packer assembly through the well tubing 12.

The well packer assembly A is lowered into position on the tubing string 12 and during such lowering the packing element B and the anchoring means C are in released or unset position. Upon the packer assembly A reaching its final position within the well casing 11 it is possible to circulate fluid downwardly through the tubing and into the lower end of the casing to wash the face of the producing formation F. Such circulating fluid returns upwardly through the annular space between the tubing and the casing since the packer is in its unset position at this time. When it is desired to set the packer, a hydraulic pressure is built up within the tubing string 12 and, as will be explained, results in setting the anchoring means C and the packing element B. Thereafter the packer assembly functions as a production packer and production of well fluids may be upwardly through the tubing string 12.

The packer is released by a manipulation and longitudinal movement of the tubing string 12 and thereafter, if desired, the tubing string may be reconnected with the packer assembly and the string employed to retrieve the packer from the well bore. As will be explained in detail, the tubing string includes a special coupling arrangement between the string 12 and the packer assembly A whereby, if necessary, an upward jarring motion may be applied

to the packer assembly to assure a positive release when removal of the packer is desired.

The details of the structure of the well packer A and its association with the tubing string 12 is clearly illustrated in FIGURES 2 and 2a. As shown in these figures, the tubing string 12 extends downwardly through the packer assembly A and is provided with an enlargement or shoulder 13 at a point just above the packer assembly. A special coupling, generally indicated at D in FIGURE 2, is employed to connect the tubing string 12 with said assembly.

The packer assembly proper includes a central tubular mandrel 14 which has its upper end connected by threads to an annular head member 15. The shoulder 13 on the well tubing string 12 is arranged to engage an annular seat 16 formed at the upper end of the bore of the head 15. An elastic packing element or sleeve 17 surrounds the mandrel 14 below the enlarged head 15 and this element may be constructed of a suitable elastic material such as rubber, rubber compound or the like.

Also surrounding the mandrel 14 and positioned below the packing element or sleeve 17 is a slip expander cone 18. The upper portion of the bore 19 of the cone has a sliding fit around the mandrel 14 but the lower portion of this bore, as indicated at 19a, is slightly enlarged to provide an annular shoulder 20. This shoulder is engageable with a support ring 21 which is secured to the exterior surface of the mandrel 14. With this arrangement it will be seen that the cone 18 is supported by means of the shoulder upon the support ring 21, and the cone in turn supports the packing element 17. The packing element is confined against upward displacement on the mandrel 14 by engagement of its upper end with the under side of the enlarged head 15 which is secured to the upper end of the mandrel. A suitable seal 22 is provided within the bore of the head 15 and seals off around the exterior of the tubing 12 which extends downwardly through the mandrel and through the entire packer assembly.

The expander cone 18 is formed with a plurality of longitudinally extending recesses or grooves 23 and the face or inner surface of each recess is inclined to form a slip expanding surface 23a. Gripping slips 24 are slidably disposed within the recesses and each slip has its inner surface inclined to co-act with the surface 23a of its groove and thus longitudinal movement of the slip members 24 with respect to the expander cone results in a radially outward movement of said slip members, whereby the same engage the wall of the well casing 11 in the usual manner.

Each slip member 24 has at its lower end a T-shaped retaining lug 25 and said lug is disposed within a complementary recess or slot 26 in the upper end of a cylinder member 27. The cylinder 27 surrounds the mandrel 14 and has its upper end formed with a cylinder head 27a, which head is slidable longitudinally with respect to the mandrel 14. Suitable sealing rings 28 seal off between the cylinder head and the external surface of the mandrel 14. An annular piston member 29 has its upper end secured to the lower end of the mandrel 14 and its lower end surrounds the tubing 12, said piston fitting within the bore of the cylinder 27. Sealing rings 30 on the piston member 29 seal between said member and the wall of the cylinder 27 while a suitable seal 31 seals off between the exterior surface of the tubing 12 and the bore of the piston member 29.

By observing FIGURE 2 it will be seen that the packing element 17, expander 18 and slips 24 are disposed above the cylinder head 27a of the cylinder 27. The piston member 29 is secured to the lower end of the mandrel 14 which extends through the bore of the packing element 17 and through the bore formed in the expander 18. When pressure is introduced into the area indicated at E in FIGURE 2, this pressure acts upwardly on the cylinder head 27 to raise the same with respect to the piston member 29. This moves the slips 24 upwardly along the inclined surfaces of the expander 18 and sets

said slips into gripping engagement with the pipe. After the slips have engaged the pipe, further upward movement of the cylinder head 27a and the cylinder 27 is halted and any pressure within the space E is transmitted against the piston member 29 which is secured, as has been explained, to the lower end of the mandrel 14. This results in a downward movement of the piston member 29 and the mandrel 14 which in turn applies a downward motion to the head 15 on the upper end of the packing element or sleeve 17. Thus, an endwise force is applied to the packing element 17 and deforms said packing element into sealing engagement with the wall of the well casing 11. It will thus be seen that introduction of pressure into the area E between the cylinder 27 and the piston 29 results in a setting of the slips followed by a deformation of the packing element into full sealing position.

For introducing pressure fluid into the area E between the cylinder and the piston, the piston member 29 is formed with an angular port or passage 32 having an annular seat 33 provided therein. A spring pressed ball check valve 34 is confined in the upper end of the passage 32 and functions to admit pressure fluid into the area E but to prevent the escape of pressure fluid therefrom. The lower end of the angular passage 32 communicates with the bore 12a of the tubing 12 through an inlet port 35, which port is normally disposed just above the seal 31 which seals off between the tubing 12 and the piston member 29. It will be obvious that when pressure is introduced through the port 35, such pressure will pass upwardly through the angular port 32, will unseat the check valve 34 and will enter the space E. After sufficient pressure has been built up to move the cylinder 27 with respect to the piston 29 so as to set the slips and deform the packing element, the pressure in the space E between the piston and cylinder is trapped and cannot escape since the back check valve 34 will be moved to its seat. It might be noted that a suitable seal 31a seals off between the piston member 29 and the exterior of the tubing 12 at a point above the lower end of the angular port 32.

The cylinder 27 is normally connected with the lower portion of the piston member by a frangible shear pin 36a. As shown in FIGURE 2 the shear pin 36a has an enlarged portion 36 which is threaded through the lower end of the cylinder. Just inside the threads this enlarged portion is provided with a flat section 37 which is slidable within a longitudinal groove 38 formed in the outer surface of the piston member 29. The shear pin is in connected position when the packer assembly A is lowered into the well bore and said shear pin assures that the cylinder will not move with respect to the piston. When pressure is introduced into the area E between the cylinder and piston, the force of this pressure will shear the pin 36a and permit the cylinder to move upwardly in the manner explained to effect a setting of the slips 24. After the pin is sheared the piston and cylinder may undergo movement with respect to each other in an axial or longitudinal direction but the engagement of the flat section 37 of the enlarged portion 36 of the fractured shear pin remains within the groove 38 so that the cylinder is nonrotatively coupled to the piston member 29.

For coupling or connecting the packer assembly to the well tubing 12 with the parts in the position shown in FIGURE 2, the special coupling D is provided. This coupling is shown in detail in FIGURE 7 and includes an upper section 40 and a lower section 41. The upper section has an upwardly extending pin 42 which threads into the lower portion of the bore of the piston member 29 below the seal 31. Said upper section is formed with longitudinal projections or fingers 43 which are inter-engaged with longitudinal projections or fingers 44 formed on the lower section 41. The lower section 41 is also formed with internal threads 45 which are left-hand threads and such threads engage complementary left-hand threads 46 which are provided on the exterior of the tubing section 12. Normally, a plurality of shear

pins 46a connect the two sections 40 and 41 of the coupling in a position with the projections or fingers of the respective sections in an extended position. It will be evident that when the shear pins 46a are fractured, the upper section may telescope the lower section within the limits of the length of the projections 43 and 44.

The special coupling D, having its upper section 40 connected with the piston member 29 of the packer assembly and the lower section 41 having its left-hand threads 45 connected with the tubing 12, functions to connect the tubing to the packer assembly. With the shear pins 46 in place the parts are in the position shown in FIGURE 2 and the well tubing 12 may be utilized to lower the assembly into position within the well bore.

The lower section 41 of the coupling D is provided with additional internal threads 47 which are left-hand threads and these are located immediately below the left-hand threads 45. The threads 47 of the lower section 41 of coupling D are adapted to be reconnected with complementary threads 48 which are formed on a collar 49 secured to the lower end of the tubing string 12. The coupling of threads 47 to the threads 48 occurs during removal of the assembly from the well bore and will be explained in detail in connection with the operation of the apparatus.

In running the packer assembly within the well casing, the parts are in the position shown in FIGURES 2 and 2a. At this time the packer assembly A is connected to the tubing string 12 through the special coupling D, said coupling making a direct connection between the tubing 12 and the piston member 29 of the packer assembly. The cylinder 27 is supported upon the piston member 29 and is connected thereto by the shear pin 36a. In turn, the slips 24 are supported upon the cylinder, the expander 18 is supported upon the support ring 21 and the packing element rests upon the expander, being confined by the enlarged head 15 secured to the upper end of the mandrel. At this time the gripping slips are retracted and the packing element is in its normal undistorted or nonsealing position.

Upon reaching the position at which the packer is to be set, downward movement of the tubing 12 is halted. At this time fluid may be circulated downwardly through the tubing, outwardly through its lower end and the return will be upwardly around the exterior of the packer assembly which is not yet in its set position. Thus, any desired circulation of fluid, washing of the well bore or formation or any other operation may be carried out prior to the time that the packer is actually moved into set position.

After circulation of desired type has been completed and it is desired to set the packer, a plug G (FIGURE 2a) is dropped downwardly through the tubing 12 and comes to rest upon a seat 50 provided within the collar 49 at the lower end of the tubing string. This plug may be of any desired construction and is illustrated as having a retrievable neck 51 at its upper end. The plug G functions to close downward flow of fluid through the bore of the tubing.

With the plug G in position, the pressure within the bore of the tubing 12 is built up and the pressure fluid is directed through the port 35 in the tubing and passes upwardly into the angular port 32, unseating the check valve 34 and flowing into the area E between the cylinder head 27a and the piston member 29. As this pressure builds up, the cylinder 27 is moved upwardly, shearing the pin 36a, and this upward movement results in the gripping slips 24 being moved into set position through their co-action with the expander cone 18. At this time the expander cone is suspended upon the support ring 21 and the slips may move upwardly thereto. Also at this time the mandrel 14 and the piston member 29 are stationary because they are coupled directly through the coupling D to the tubing string which is hanging stationary in the well bore. After the slips 24 move into

set position a further upward movement of the cylinder is resisted and the force of the pressure fluid then acts downwardly against the piston member 29. This downward force is sufficient to shear the pins 46a in the special coupling member D and as soon as the pins shear, the piston member 29 and the mandrel 14 may be moved downwardly relative to the tubing 12. The length of the projections or fingers 43 and 44 of the coupling is such that sufficient downward movement of the piston member 29, mandrel 14 and enlarged head 15 may occur to assure that the packing element 17 is distorted by the endwise force applied through the head 15 which is attached to said mandrel; this downward force is applied without pulling downwardly on the tubing 12 and, therefore, the packer is set without placing an undue stretch in the tubing string.

As soon as the packing element is deformed outwardly into tight sealing engagement with the wall of the casing 11, further downward motion of the piston member and mandrel is halted. The pressure, which has been introduced into the area or space E between the cylinder head 27a and the piston member 29, is trapped in this area because the check valve 34 closes. Thereafter, pressure within the bore of the tubing 12 may be relieved and the packer assembly will remain in its set position. It is noted that since the head 15, which is in contact with the upper end of the packing element, moves in a downward direction to set the packing element, the hydrostatic head of fluid in the annulus above head 15 is acting upon said head to urge the same downwardly and thereby assist in maintaining the packer in set position. By reason of the annulus pressure acting upon the head 15 to assist in the setting and subsequent maintenance of the packer in set position, it is evident that by controlling the annulus pressure, the amount of pressure which must be applied to the piston and cylinder may also be controlled.

After the packer is set, a wire line may be utilized to retrieve the plug G to again open the bore of the tubing 12 and permit well fluids to be produced therethrough. The position of the parts in fully set position is illustrated in FIGURE 4.

At any time that removal of the packer assembly A is necessary or desired, the tubing string 12 is rotated to the right and this results in uncoupling the left-hand threads 46 on the tubing from the left-hand threads 45 provided in the lower section 41 of the coupling D. The uncoupling of these threads may be accomplished because the section 41 is held stationary through interengagement of its projections 44 with the projections 43 of the upper section 40; the latter section being, of course, secured to the piston member 29 which is nonrotatable within the casing. As soon as the threads 45 and 46 are uncoupled, the tubing 12 may be lifted upwardly with respect to the packer assembly and such upward movement is continued until the opening or port 35 in the tubing is raised above the packing 31a and is moved into alignment with a relief port or opening 51 which is formed in the mandrel 14 adjacent the upper end of the piston 29. When the ports 35 and 51 are in registration, the pressure within the area or space E, which was previously trapped, may be relieved into the bore of the tubing and this releases the forces which have held the packing element and the slips in set position.

At the same time that the ports 35 and 51 move into registration, an annular recessed portion 52 provided in the external surface of the tubing 12 below the shoulder 13, is moved upwardly to span the upper seal 22 and effect an equalization of pressure around the packing element. Release of the trapped pressure from the area or space E and equalization of pressures across the various elements of the packer assembly relieves the pressure which was acting upon the piston and cylinder. Thereafter, it is only necessary to lift upwardly on the tubing string until the collar 49 engages beneath the lower sec-

tion 41 of the coupling D, which transmits an upward lift through piston 29, mandrel 14 and support ring 21 to the expander to release the slips, whereby the entire assembly may be removed from the bore.

However, if a straight upward pull on the assembly does not release the assembly, it may be necessary to jar upwardly upon the cone 13 to remove said cone from between the slips and thereby effect a release of the assembly; if such operation is necessary, the tubing is raised until the threads 48 of collar 49 engage the threads 47 in the lower section 41 of coupling D. Upon subsequent right-hand rotation, the lower section 41 of coupling D is directly connected to the collar 49 to reconnect the coupling D to the tubing 12. It is now possible by misaligning the projections 44 and 43 to take an upward pull or strain on the tubing 12 and then by rotating the lower section 41 to cause the projections 44 of section 41 to suddenly become aligned with the spaces between projections 43 of the upper section 40 of the coupling, thereby imparting a sudden upward jar to the piston member 29. The piston member 29, being directly connected to the mandrel 14, transmits the upward jar to said mandrel and then, through the support ring 21, the jar is imposed through shoulder 20 directly upon the cone 18. By repeating the jarring action, which is permitted by the projections 43 and 44 of the sections of the coupling D, the expander cone may be driven upwardly from between the gripping slips to assure a positive release of the anchoring means and of the packing element 17, whereby removal of the assembly is assured.

In FIGURES 2 and 4 the back check 34 has been shown as a simple ball check device. However, where the packer is maintained in set position over a long period of time, it is necessary to hold the pressure trapped during such period with no leakage. Therefore, it may be desirable to provide a double check valve to assure that there will be no leakage after the packer has been set. In FIGURE 6 a modified form of check valve arrangement is illustrated. As shown in this figure, an angular passage 32a is located in substantially the same relationship in the piston member 29 as is the passage 32. Passage 32a has an annular seat 60 which is engaged by a spring pressed ball 61. Above the seat 60, the passage is enlarged as indicated at 62 and a second valve seat 63 is provided. The seat 63 may be located within a member insertable within the enlarged portion 62 and held in place by a plug 64. Confined between the plug 64 and the seat 63 is a second back check, spring pressed valve 65. In the event that valve 65 should fail to properly seat or for some reason should leak, the valve 61 provides a second back check which will assure that the pressure will be retained in the area or space E and thereby assure that the packer will remain in its set position even over long periods of time.

From the foregoing it will be seen that a simple and effective type of hydraulically-actuated packer is provided. The special coupling D not only provides for downward motion of the piston member and mandrel during setting of the packing element without imparting that same movement to the tubing string, but also said coupling incorporates the jar device which will be most effective during the removal of the assembly. It is, of course, evident that during the setting of the packer, the forces applied should not be applied to the tubing string because this would result in stretching the string and placing it under an undue strain. When the pins 46a of the special coupling are sheared, downward movement of the piston 29 and the mandrel 14 may occur without in any way imparting that same movement to the tubing string 12. Although the jar feature is provided in the coupling D by reason of the interengaged projections 43 and 44, it may not be necessary to employ this feature at all times. As has been noted, after the pressure between the piston and cylinder has been released and pressures across the packing element equalized, a straight upward movement on the tub-

ing string may result in removal of the entire assembly. However, if such upward movement of the tubing does not release the packer, then the jar feature may be employed to drive the expander cone upwardly from between the gripping slips 24, so that positive release is assured. Of course, when the jar feature is to be employed, it is necessary that the threads 47 at the lower end of the section 41 of coupling D be engaged with the threads 48 of the enlarged collar 49 because it is this connection which again reconnects the lower section 41 of coupling D with the tubing string.

It is pointed out that the mandrel 14 extends entirely through the packing element 17 and entirely through the expander cone; with this arrangement the inner surface or bore of the packing element 17 is not engaged with the exterior of the tubing string 12. For this reason, the tubing string may be readily manipulated, first rotated to disconnect the left-hand threads 45 and 46, and then moved longitudinally through the packer assembly without any appreciable frictional resistance. It is evident that if the packing element 17 engaged the exterior surface of the tubing string when in its set position, its bore engaging the tubing would create considerable frictional resistance to both rotative and longitudinal movement of said tubing. Further, the provision of the mandrel 14 directly connects the piston 29 with the enlarged head 15 and when pressure is applied between the piston and its cylinder, the applied pressure force is contained within the packer assembly and is not transmitted to the coupling threads 42 or to the shoulder 13 on the tubing string. Therefore, the tubing string is not subjected to undue stress because the load is carried by the mandrel and this also facilitates release of the device where pressure forces are relieved.

Although ball check valves have been found satisfactory for effectively sealing against the escape of pressure from the area E between the cylinder and piston, any suitable type of back check valve may be employed.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction, may be made within the scope of the appended claims without departing from the spirit of the invention.

What I claim is:

1. A well packer assembly including, a mandrel, an enlargement connected to the upper end of the mandrel, a packing element surrounding the mandrel and having its upper end adjacent the enlargement whereby the packing element is confined against upward movement with respect to the mandrel, anchoring means also surrounding the mandrel below the packing element, hydraulically-actuated means comprising two elements movable relative to one another, the first of said two elements having connection with the anchoring means so that said anchoring means is set upon movement of said first element, the second of said elements having connection with the mandrel so that said mandrel is moved when said second element is moved relative to said first element to move the enlargement at the upper end of the mandrel and thereby apply an endwise force to the packing element to deform the same into sealing position, a tubular conductor extending entirely through the packer assembly, coupling means connecting said conductor to said second element, and means establishing communication between the bore of the conductor and said hydraulically-actuated means to operate the latter and thereby set the anchoring means and packing element, the enlargement on said mandrel being exposed to the pressure in the area above the set packer which pressure acts downwardly upon the enlargement to urge and maintain the packing element in its set position.

2. A well packer assembly including,
a tubular conductor,
a mandrel surrounding said conductor and mounted for limited sliding movement thereon,

an elastic packing element surrounding the mandrel, means secured to the mandrel confining the packing element against upward displacement on the mandrel, a gripping slip expander surrounding the mandrel and engaging the lower end of said packing element, means for limiting the downward movement of the expander on the mandrel, gripping slips coacting with the expander, a movable cylinder member slideably surrounding the mandrel and engaging the slips, a piston member secured to the mandrel, means for also connecting the piston member to the tubular conductor, and means including the tubular conductor for conducting a pressure fluid into the area between the piston member and the movable cylinder member to impart movement to the latter and move the gripping slips relative to the expander to set the same, setting of said slips preventing a subsequent downward movement of the expander and the lower end of the elastic packing element, as well as arresting a further upward movement of the cylinder member and gripping slips, whereby the continued application of pressure between the cylinder member and the piston member applies a downward force to the piston member to move said piston member and the mandrel secured thereto downwardly relative to the packing element to apply endwise force to said packing element through the confining means secured to said mandrel and distort said element into sealing position.

3. A well packer assembly as set forth in claim 2, wherein the means connecting the piston member to the conductor includes, a coupling unit comprising a pair of telescoping sections, one of which is secured to the piston member and the other of which is secured to the conductor, means releasably connecting the sections to each other and adapted to be released when a force is applied to the piston member in a downward direction following setting of the gripping slips, said sections having a predetermined movement relative to each other which is sufficient to allow downward movement of the piston member and mandrel to deform said packing element, such downward movement of the piston member and mandrel occurring with respect to the conductor and also relative to the expander and gripping slips.

4. A well packer assembly as set forth in claim 2, together with, means located between the tubular conductor and the area between the piston member and the cylinder member for trapping the applied pressure within said area, the tubular conductor having a pressure release port which is normally sealed from communication with said area between said piston member and cylinder member, said means which connects the piston member to the conductor being releasable so that upon release, the conductor may be moved relative to the piston and cylinder member to communicate the release port with the area between said piston and cylinder members and thereby relieve the pressure maintaining the packer assembly in set position, and coacting means on the conductor and connecting means for releasing said connecting means by manipulation of the conductor.

5. A well packer assembly as set forth in claim 3, together with coacting reconnecting means on said conductor and on one of the sections of the coupling unit for subsequently reconnecting said conductor to said coupling unit.

6. A well packer as set forth in claim 3, wherein the telescoping sections of the coupling unit include interengaging projections, which may be reciprocated relative to each other after the means connecting the sections has been released to thereby apply an upward jarring action to the piston member when said conductor is manipulated.

7. A well packer assembly including, a tubular mandrel, a packing element surrounding said mandrel, anchoring means also surrounding the mandrel below the packing element, hydraulically-actuated means having two relatively movable parts with one part engageable with the anchoring means, a tubular conductor extending entirely through said mandrel, a coupling unit connecting said conductor to the second movable part of the hydraulically-actuated means, whereby said conductor may be utilized to lower the assembly into a well bore, means including said conductor for directing pressure fluid to the hydraulic means to move its parts relative to each other to set the anchoring means and packing element, a releasable connection in the coupling unit for disconnecting the conductor from the movable part of said hydraulically-actuated means, whereby said conductor may be moved within limits relative to hydraulically-actuated means, anchoring means, packing element and mandrel,

means actuated by a predetermined movement of the conductor for releasing the anchoring means and packing element from set position, and an enlargement on the lower end of the conductor below the hydraulically-actuated means for limiting the downward movement of said hydraulically-actuated means, the anchoring means, packing element and mandrel on said conductor, whereby said conductor may be utilized to retrieve the complete assembly from the well bore.

8. In combination with a well packer assembly comprising, a mandrel, a packing element surrounding the mandrel and confined against upward movement thereon, anchoring means also surrounding the mandrel below the packing element, hydraulically-actuated means having engagement with the anchoring means and having connection with the mandrel and upon operation coacting with the anchoring means and the mandrel to first move the anchoring means into set position and thereafter to move the mandrel downwardly relative to the anchoring means to apply endwise force to the packing element to deform the same into sealing position,

a conductor and coupling unit including a tubular conductor extending entirely through the mandrel of the packer assembly, and a coupling means between the conductor and the hydraulically-actuated means, said coupling means comprising two telescoping sections, one of which is secured to the conductor and the other of which is secured to the hydraulically-actuated means, releasable means securing said telescoping sections to each other, release of said releasable means permitting relative movement of a portion of the hydraulically-actuated means with respect to the conductor, whereby said packer assembly may be set while the conductor remains stationary.

9. A well packer assembly as set forth in claim 8, wherein the telescoping sections of the coupling means include interengaging projections which may be reciprocated with respect to each other after the releasable means connecting the sections has been released, whereby

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manipulation of the conductor will reciprocate said sections to apply an upward jar to the piston member.

10. A well packer assembly as set forth in claim 8, wherein

the telescoping sections of the coupling means interengaging projections which may be reciprocated with respect to each other after the releasable means connecting the sections has been released, whereby manipulation of the conductor will reciprocate said sections to apply an upward jar to the piston member, and coacting means on said conductor and on one of the sections of the coupling means for reconnecting said conductor to said coupling means to prevent relative movement of the conductor relative to the coupling means and relative to said hydraulically-actuated means secured to the coupling means.

11. The combination with a well packer assembly which includes a packing element, anchoring means and hydraulically-actuated means for setting the anchoring means and deforming the packing element into sealing position,

of a conductor and coupling unit comprising, a tubular conductor which extends entirely through the packer assembly,

a coupling means attached to the lower end of the well packer assembly,

releasable means on said coupling means which releasably connects said coupling means with the conductor, whereby the conductor may be utilized to initially lower said packer assembly within the well bore,

means including the conductor for establishing communication between the bore of the conductor and the hydraulically-actuated means for the packer assembly whereby pressure fluid may be directed from said conductor to the hydraulically-actuated means to set the anchoring means and deform the packing element into sealing position,

release of the releasable means of the coupling means disconnecting the conductor from the packer assembly after the same is set to permit a limited longitudinal movement of the conductor relative to the packer,

means in the conductor coacting with the hydraulically-actuated means upon a longitudinal movement of the conductor for releasing the pressure fluid which initially sets the gripping slips and packing element of the assembly,

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and additional coacting means on said coupling means and on said conductor for reconnecting the conductor to the packer assembly after the packer assembly has been released whereby the conductor may be employed to retrieve the assembly from the well bore.

12. The combination set forth in claim 11, wherein the coupling means comprises,

a pair of telescoping sections, one of which is secured to the conductor and one of which is secured to a portion of the hydraulically-actuated means, said releasable means releasably connecting said sections, said telescoping sections having interengaging projections which are reciprocable within limits relative to each other when said releasable means is released, whereby the conductor may undergo limited longitudinal movement with respect to the well packer assembly to apply an upward jarring action to said assembly to effect its release from a set position.

13. The combination set forth in claim 11, wherein the coupling means comprises,

a pair of telescoping sections, one of which is secured to the conductor and one of which is secured to a portion of the hydraulically-actuated means, said releasable means releasably connecting said sections,

said telescoping sections having interengaging projections which are reciprocable within limits relative to each other when said releasable means is released, whereby the conductor may undergo limited longitudinal movement with respect to the well packer assembly to apply an upward jarring action to said assembly to effect its release from a set position, and

additional coacting means on the conductor and on one of the sections of the coupling means to reconnect said conductor to the well packer assembly.

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