

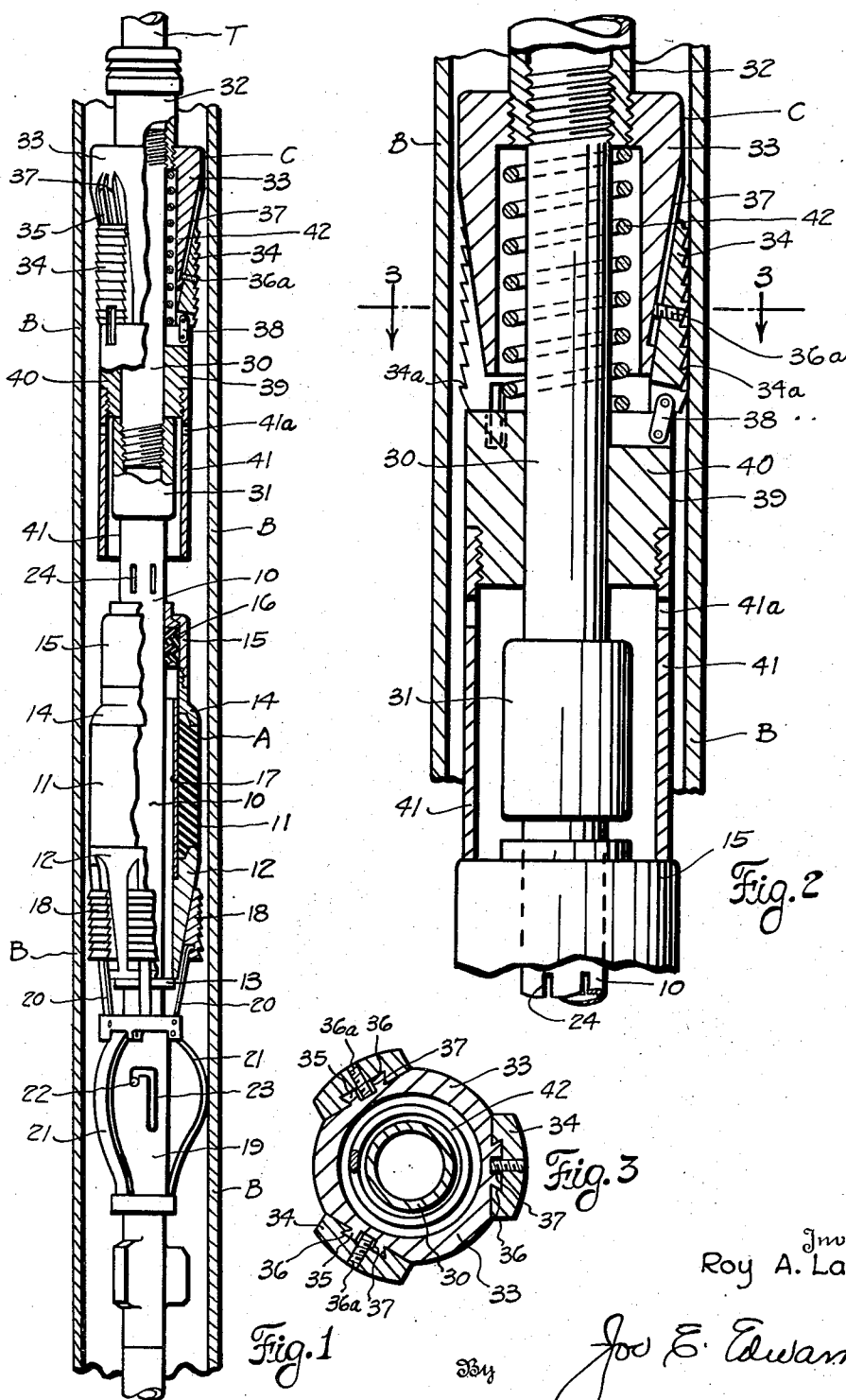
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ANCHORING DEVICE FOR WELL PACKERS

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ANCHORING DEVICE FOR WELL PACKERS

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This invention relates to new and useful improvements in anchoring devices for well packers.

The usual type of well packer which is employed for "packing off" or sealing the annular space between a well tubing and a well casing is ordinarily connected in the well tubing and includes a plurality of gripping slips which are adapted to be moved outwardly into a set position in engagement with the wall of the casing. When the slips are in a set position, the packing member, generally in the form of an annular sleeve, is distorted into packing position by the weight of the tubing string and this weight is also depended upon to hold the slips in their expanded, gripping position, said slips being constructed to prevent downward movement of the assembly. The gripping slips perform no function in locking the packer against upward movement and only the weight of the tubing string resists such upward displacement. As wells are drilled to deeper depths with increased bottom hole well pressures, the weight of the tubing in which the well packer is connected has been found insufficient to prevent the upward displacement of the packer assembly by these higher well pressures and it is therefore desirable that a positive anchoring or locking of the well packer against unintentional upward movement be provided to assure maintenance of the "packing off" or sealing action of said packer.

It is one of the objects of the present invention to provide an improved anchoring device which may be readily combined with the usual type of well packer and which has means for positively locking the assembly against unintentional upward displacement.

An important object of the invention is to provide an improved anchoring device for well packers which device is constructed in the form of an attachment whereby it may be easily connected with an ordinary well packer without changing the structure of the latter; said device including gripping slips which have their gripping teeth disposed in a direction to lock the assembly against upward movement in the well casing or pipe, said gripping slips of the attachment being urged into tight gripping engagement by the pressure force below the packer and functioning to positively prevent upward movement while the usual gripping slips of the well packer act to prevent downward movement of the assembly to assure positive locking of said assembly in both directions.

Still another object of the invention is to provide an improved anchoring device, of the char-

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acter described, which is arranged to be connected to the support or mandrel of the well packer and which is so constructed that the gripping slips of the well packer may be initially set in the usual manner to lock the assembly against downward movement after which the gripping slips of the anchoring device may be set to lock the assembly against upward displacement; release of the assembly being accomplished merely by a lifting of the well tubing which initially releases the slips of the anchoring device and subsequently releases the slips of the well packer whereby the device may be set, then released and reset at any desired elevation and any desired number of times without removal from the well pipe.

A particular object of the invention is to provide an improved auxiliary anchoring device for well packers, wherein the packing member of the well packer is moved into its expanded or sealing position prior to the time that the gripping slips of the auxiliary anchoring device are engaged with the well casing or pipe to lock the packer assembly against upward movement; the construction being such that the expanded packer member is engaged with or contacts the gripping slip unit of the anchoring device so that the force of any pressure below the packing member tending to move said member upwardly is transmitted to the gripping slip unit to force the gripping slips thereof into a tighter gripping engagement with the well casing or pipe to assure the prevention of upward displacement of the assembly and maintenance of the packing seal.

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

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

Figure 1 is a view, partly in section and partly in elevation of the improved anchoring device, constructed in accordance with the invention, and illustrating said device connected with an ordinary well packer, the gripping slips of both packer and anchoring device being in a retracted position,

Figure 2 is an enlarged, transverse, vertical, sectional view of the anchoring device, with the slips thereof in an expanded or gripping position, and

Figure 3 is a horizontal, cross-sectional view, taken on the line 3—3 of Figure 2.

In the drawings, the letter A designates an ordinary well packer which is generally known as a simple hook wall type of packer. The packer includes a tubular mandrel 10 which forms the main support of the packer assembly. An annular elastic packing sleeve 11 surrounds the mandrel and has its lower end confined within a slip expanding cone 12 which cone is normally supported upon a supporting ring 13 secured to the mandrel. The upper end of the packing element is confined within the recessed lower portion of a retaining collar 14 and a packing gland 15 fits within the upper end of the retaining collar. The packing gland includes suitable packing rings 16 preferably of the pressure seal type which pack off the annular space between the exterior of the mandrel 10 and the interior of the packing element 11 and cone 12. A suitable re-inforcing sleeve 17 is disposed within the bore of the annular packing element or sleeve 11 and has its ends extending beyond the upper and lower ends of the packing sleeve.

Gripping slips 18 which have their gripping teeth disposed to prevent downward movement when said slips engage the wall of a well pipe or casing B, are mounted to slide on the slip expanding cone 12. The slips are connected to a tubular slip carrier 19 by links 20 and the carrier is slidable on the mandrel 10. Arcuate flat friction springs 21 are secured to the slip carrier and normally ride upon and frictionally engage the wall of the well pipe or tubing B. The carrier is connected to the mandrel 10 by means of a gudgeon or radial pin 22 which extends outwardly from the mandrel and which engages within an inverted J-slot 23 formed in the carrier.

The well packer above described is of usual construction and is arranged to be set within the well pipe or casing in the usual manner. Normally the parts are in the position shown in Figure 1 and when it is desired to set the packer, the mandrel is lifted a slight distance and then rotated so as to align the gudgeon or pin with the long leg of the slot 23; the mandrel is then moved downwardly to permit lowering of the slip expanding cone 12, the gripping slips being maintained stationary by means of the friction springs 21 which hold the carrier and slips against movement. Obviously, as the cone moves downwardly with respect to the gripping slips, said slips are expanded outwardly into engagement with the well casing B in the usual manner to lock the assembly against further downward movement. The mandrel is formed with by-pass slots or openings 24 which when the mandrel moves downwardly to set the packer and expand the packing sleeve moves into or below the packing rings 16 to close said slots.

As explained, the particular construction of the packer A is subject to variation and may be any one of a number of packers now in general use. So long as the well packer is constructed with its packing member or sleeve capable of independent movement relative to the mandrel or tubing on which it is mounted, whereby said packing member is slidable on said mandrel or tubing, the present invention may be combined therewith. In the usual type of well packers wherein the packing member is slidable relative to its mandrel, the slips are arranged to lock the assembly against downward movement within the well tubing and no positive locking against

upward displacement of the assembly is provided. Only the weight of the tubing or pipe to which the mandrel 10 is connected is depended upon to maintain the packer in its set position. If the pressure beneath the packer is excessive, such pressure acts against the "set" packing member or sleeve and tends to lift or raise said sleeve upwardly. Should this pressure become sufficient the packing sleeve is forced upwardly which results in lifting the entire tubing string and "kinking" or bending said string or in many cases, "blowing" said tubing upwardly out of the well bore.

In carrying out the present invention, an anchoring device C which is constructed in the form of an attachment for an ordinary well packer is provided. This anchoring device includes a tubular mandrel 30 which has its lower end coupled to the upper end of the well packer mandrel 10 by a coupling collar 31. The upper end of the mandrel is connected to a fishing neck 32 which in turn is coupled to the well tubing T. A slip expanding cone 33 is threaded onto the lower portion of the neck 32 and is thereby affixed or secured to the mandrel 30. A plurality of gripping slips 34 are slidable on the slip expanding cone 33, being retained thereon by suitable dove-tailed ribs 35 which engage recesses 36 in the inner wall of the slips. Each slip is retained against displacement on the cone by a threaded pin 36a which extends through the slip and engages longitudinal grooves 37 formed in each dove-tail 35.

The slips 34 are connected by links 38 with a slip carrier 39. This slip carrier includes a collar 40 which surrounds the tubular mandrel 30 and which has a tubular sleeve 41 secured to its lower portion and extending therebelow. The coupling collar 31 which connects the mandrel 30 with the mandrel 10 of the well packer is disposed within the sleeve 41 and the upper end of said collar is adapted to engage the underside of the collar 40 of the slip carrier 39. When the gripping slips are in their lowered position on the cone 33, as shown in Figure 1, said slips are in a retracted position. This position of the slips is normally maintained by means of a coil spring 42 which surrounds the mandrel 30 and which is confined between the underside of the neck 32 and the top of the slip carrier 39, said spring constantly exerting its pressure to urge the slip carrier and slips attached thereto downwardly with respect to the cone 33.

In the operation of the anchoring device C, said device is connected to the ordinary well packer A by the coupling collar 31 and the parts are in the position shown in Figure 1 with the slips 18 of the packer, as well as the slips 34 of the anchoring device, in their retracted position. When the position at which the packer is to be set is reached, the well tubing, mandrel 30 and mandrel 10 are all rotated so as to move the connecting pin or gudgeon 22 of the well packer into a position aligned with the long leg of the slot 23 in the slip carrier of the packer. The tubing is then moved downwardly to lower the mandrel 30 and mandrel 10 and as explained, lowering of the mandrel 10 will result in setting the gripping slips 18 of the well packer. When this occurs, further downward movement of the expanding cone 12 of the packer and the packing element 11 is prevented.

As the tubing is subsequently lowered, the lower end of the sleeve 41 of the slip carrier 39 of the anchoring device C strikes the upper end of

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the well packer assembly and this engagement of the sleeve will tend to expand the packing element 11 of the well packer. Downward movement of the sleeve 41 will continue until the packing element 11 is expanded or distorted radially outwardly into sealing position and when this occurs, further downward movement of the sleeve is prevented. Since the sleeve forms a part of the slip carrier 39 of the anchoring device C, halting of downward movement of said slip carrier prevents further downward movement of the gripping slips 34 connected therewith. However, the tubing T and mandrel 30 may continue to move downwardly until the slip expanding cone 33 of the anchoring device has moved downwardly with respect to the stationary gripping slips 34 sufficiently to expand said slips into gripping position, as shown in Figure 2. At this time the collar 31 which connects the mandrel 30 with the mandrel 10 is spaced above the packing gland 15 so a direct contact between the packing sleeve assembly of the well packer and the mandrel 30 is not had. The teeth 34a of the slips 34 are disposed in a direction opposite to the gripping teeth of the slips 18 of the well packer and therefore their engagement with the well casing or pipe B will lock the entire assembly against upward displacement within the pipe. Thus, after the slips of the anchoring device have been set, the assembly is locked against movement in both directions in said pipe.

It will be evident that with the slips 34 of the anchoring device in their set position, the sleeve 41 of the slip carrier is engaging the upper end of the packing member assembly of the well packer. Any pressure below the well packer which acts against the packing member 11 thereof will tend to lift or raise said packing member and obviously this force will be transmitted through said packing member directly to the sleeve 41 of the slip carrier of the anchoring device. This force urges the slip carrier and the slips 34 attached thereto upwardly on the expanding cone 33 which is, of course, held stationary by the mandrel 30 and tubing string. Therefore, any force exerted against the packing member 11 of the well packer which would tend to raise or lift said member is transmitted to the gripping slips 34 of the anchoring device to urge said slips into tighter gripping position and thereby positively lock the entire assembly against upward displacement within the well bore.

In order to remove the assembly, it is only necessary to raise the well tubing T which will exert an upward pull on the slip expanding cone 33 of the anchoring device C and this will move said cone upwardly with relation to the slips, whereby the slips 34 being dove-tailed to the cone, will move inwardly to their retracted position. It is noted that the coil spring 42 assists in forcing the slips 34 toward their retracted position on the cone 33. Continued raising of the tubing will result in the recovery ring 13 on the mandrel 10 of the well packer striking the cone 12 of said packer and thereby effect a retraction of the slips 18. Manifestly the assembly could be moved to another elevation and reset without removal of the assembly from the well tubing B.

The device is relatively simple in construction and may be attached to any standard type of well packer having slips for locking said packer against downward movement and also having its packer member assembly slidably mounted on its supporting mandrel or tubing. It might be noted that the sleeve 41 of the slip carrier 39

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may be provided with relief or by-pass ports 41a to permit the escape of any liquid which may enter said sleeve during lowering of the device within the pipe. The anchoring device provides a positive means for locking the entire assembly against upward movement within the pipe and obviously its slips, functioning jointly with the slips of the well packer will lock said packer against unintentional upward displacement within the well casing.

The foregoing description of the invention is 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 and desire to secure by Letters Patent is:

1. The combination with a well pipe and a well packer therein comprising a packer support, an expansible packing element on said support, and gripping slips on said support below said packing element movable to gripping position gripping the well pipe to lock the packer against downward movement in the well pipe to permit the packing element to be distorted into sealing position between the packer support and well pipe, of an anchoring device having a mandrel secured to the upper end of the well packer support, said anchoring device also including radially movable gripping slips, and means operable by downward movement of the mandrel and well packer support relative to the distorted packing element for moving said anchoring device gripping slips into gripping position to lock the packer assembly against upward movement within the well pipe, said last named means being operable only after the gripping slips of the well packer have been moved into a gripping position.

2. The combination with a well pipe and a well packer therein comprising a packer support, an expansible packing element on said support and gripping slips on said support below said packing element movable to gripping position between the packer support and well pipe to lock the packer against downward movement in the well pipe to permit the packing element to be distorted into sealing position, of an anchoring device including, a mandrel connected to the support of the packer, a downwardly tapering slip expanding member secured to the mandrel, a slip carrier below the slip expanding member surrounding the mandrel and movable thereon, and gripping slips attached to the slip carrier and slidable on the slip expanding member whereby when said member is moved downwardly with respect to the slips, said slips are urged radially outwardly into gripping position with the well pipe, the anchoring device gripping slips having gripping means constructed to grip the well pipe to lock the anchoring device and connected well packer against upward movement in the well pipe, the lower end of said slip carrier being engageable with the upper end of the packing element after the latter has been distorted into sealing position upon lowering said mandrel and support relative to the distorted packing element whereby such engagement halts further downward movement of the slip carrier and gripping slips of the anchoring device to allow the slip expanding member to move downwardly relative to the slips to move the slips radially outwardly to grip the well pipe and hold the packing element in sealing position.

3. The combination as set forth in claim 2, together with a coiled spring surrounding the mandrel of the anchoring device and confined between the slip expanding member and the slip carrier for urging these parts toward a separated position whereby the gripping slips of said anchoring device are normally urged toward a retracted or non-gripping position.

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