

July 24, 1962

M. B. CONRAD
TUBING ANCHOR

3,045,757

Original Filed Jan. 22, 1957

3 Sheets-Sheet 1

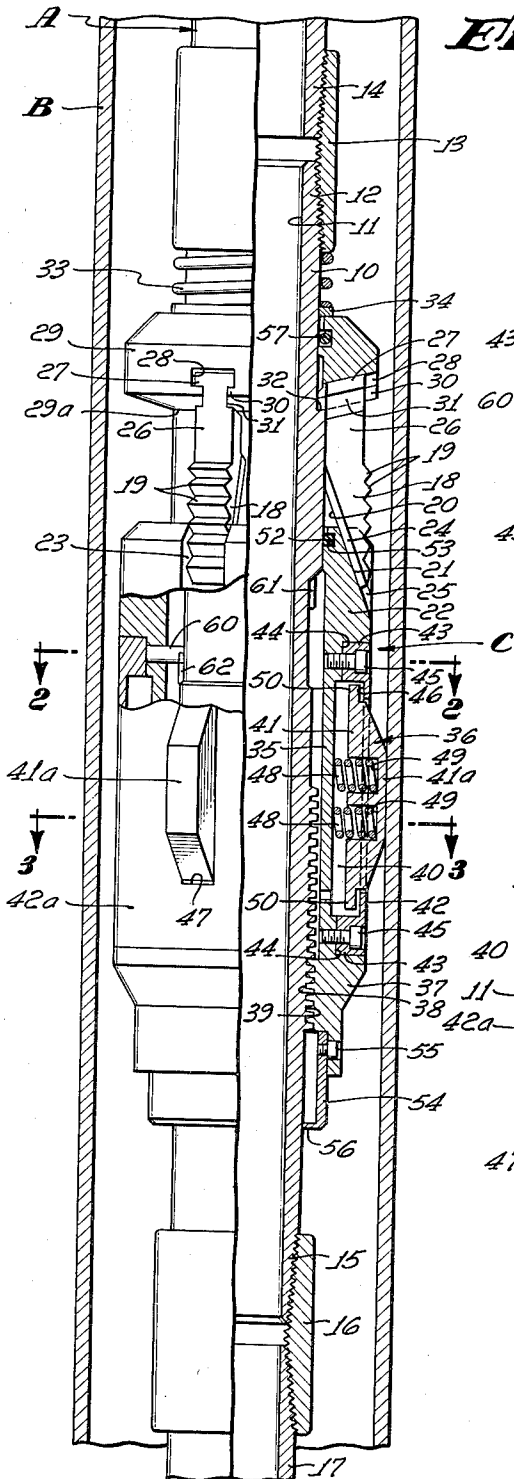


Fig. 1.

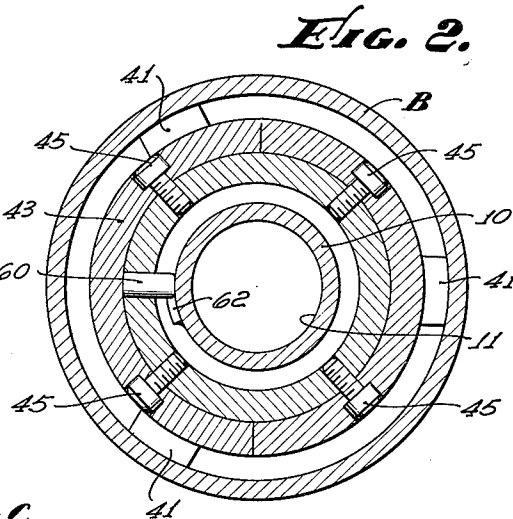


Fig. 2.

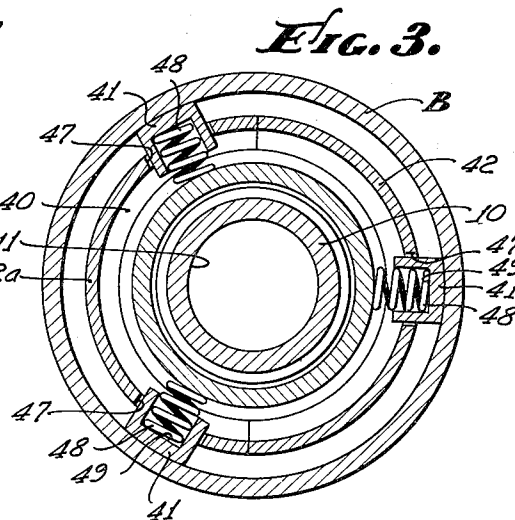


Fig. 3.

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3 Sheets-Sheet 2

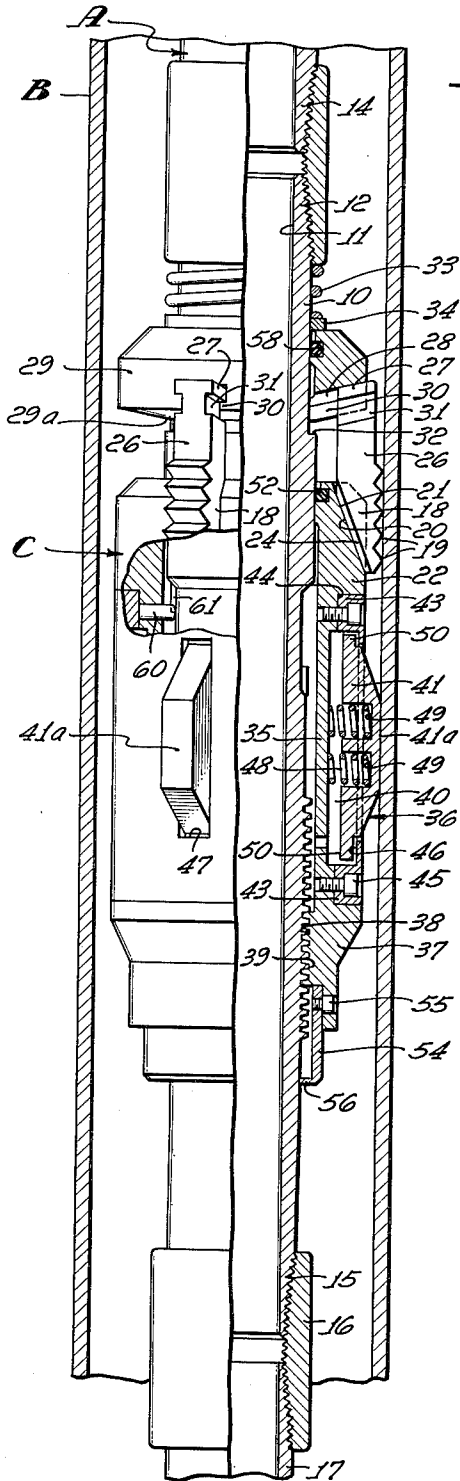


FIG. 4.

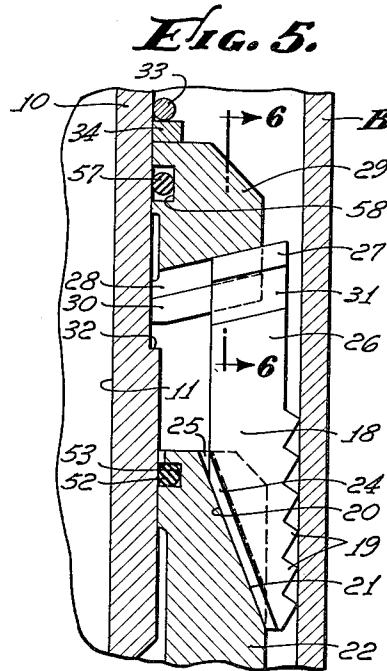


FIG. 5.

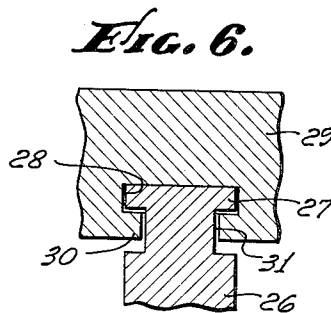


FIG. 6.

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3 Sheets-Sheet 3

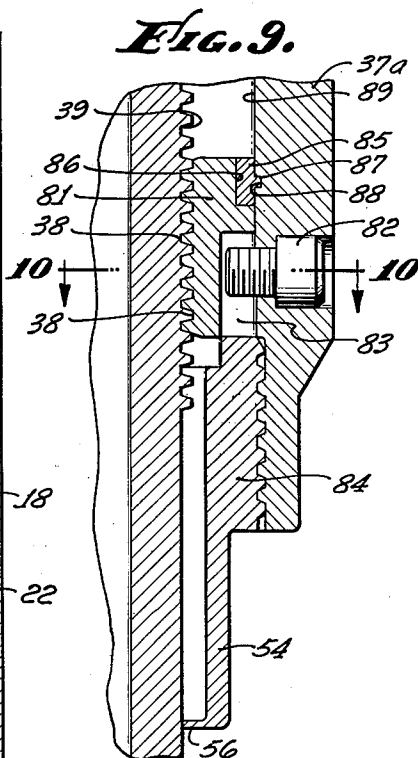
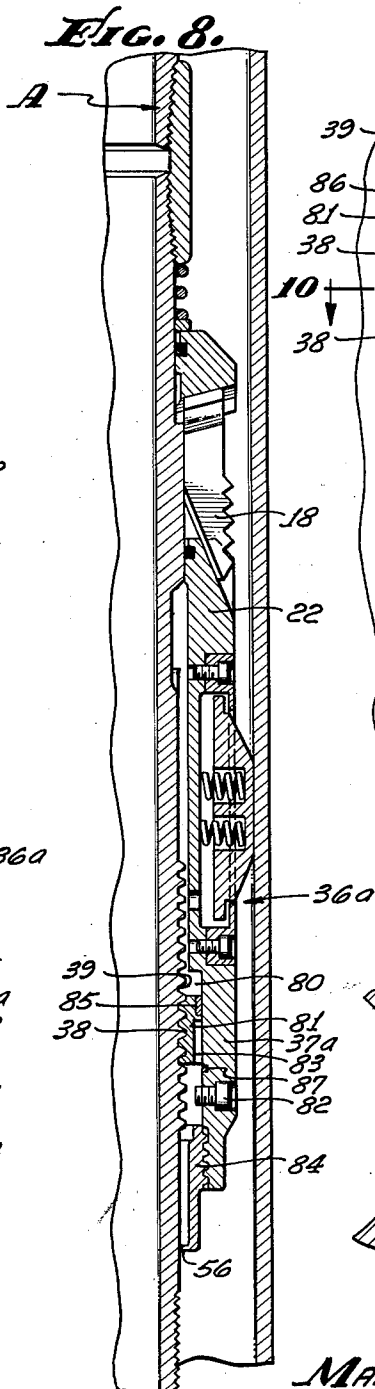
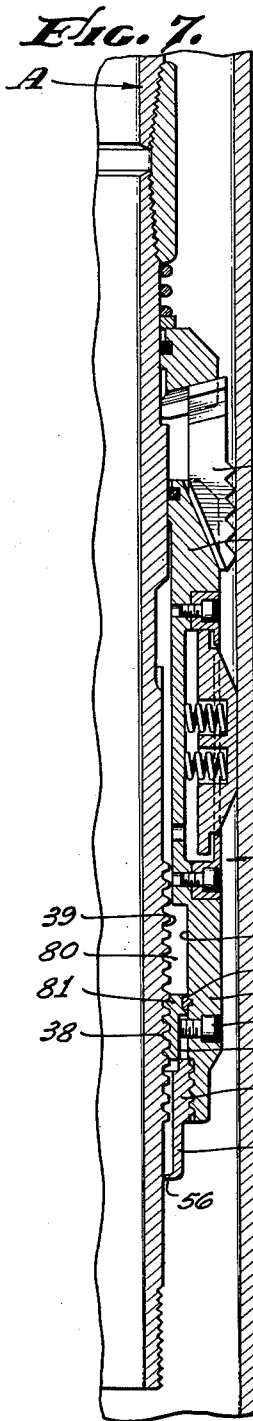
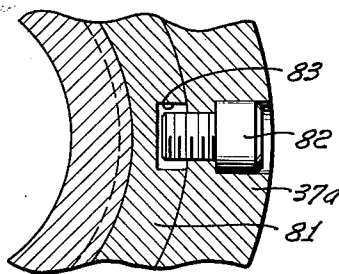


Fig. 10.



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3,045,757

TUBING ANCHOR

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Continuation of application Ser. No. 635,307, Jan. 22, 1957. This application Oct. 17, 1960, Ser. No. 63,218
27 Claims. (Cl. 166—216)

The present invention relates to subsurface well apparatus and more particularly to apparatus for anchoring running-in string, such as strings of tubing, to well casing, liners, or the like.

This application is a continuation of my application for "Tubing Anchor," Serial No. 635,307, filed January 22, 1957, now abandoned.

Tubing anchors are used within well casing to secure tubular production strings to the well casing. An anchor has the purpose of preventing the reciprocations of a deep well pump from inducing corresponding reciprocations in the production tubing, which reduces the effective stroke of the pump and its positive displacement. To secure the desired positive displacement of the pump, the anchor enables a predetermined tension or pull to be taken on the tubing string. However, in actual practice, such tension or pull is not maintained. Instead, it is found that the reciprocation or "breathing" of the production tubing as a result of the pumping action intermittently releases and resets the anchor in the casing, actually causing the anchor to be pounded or hammered against the casing wall with exceedingly harmful results. In addition, increase in temperature of the production tubing causes it to expand and correspondingly reduces its tension, allowing it to reciprocate with the pump to some extent, again causing intermittent release and resetting of the anchor in the casing. In fact, if the elongation of the production string is sufficient, the anchor will be released and will remain in the released condition.

Accordingly, it is an object of the present invention to provide a subsurface anchor for a tubular string that is capable of automatically shifting its anchoring position in the well casing as the length of the tubular string changes, in order to maintain the tubular string in tension in the well casing.

Another object of the invention is to provide a subsurface anchor for a tubular string which automatically follows the tubular string down the casing as the latter elongates under the influence of a reciprocating deep well pump, or as a result of increase in temperature of the tubular string, or both, thereby minimizing the tendency for the tubular string to be reciprocated by the pump.

A further object of the invention is to provide a subsurface anchor for a tubular string, in which the anchor automatically assumes a proper location in the well casing to place the tubular string in tension as an incident to the reciprocations of the deep well pump operating within the tubular string.

An additional object of the invention is to provide an improved subsurface anchor that can be run in a well casing with its gripping members or slips secured in retracted position, the slips being positively shiftable against the well casing, and the slips being positively retractable whenever the anchor is to be removed from the well casing or shifted to another location therewithin.

Another object of the invention is to provide a subsurface anchor for a tubular string embodying slips to grip the casing in which the anchor is used, and in which assurance is had that the slips can be retracted under conditions that might tend to preclude their normal retraction.

This invention possesses many other advantages, and has other objects which may be made more clearly ap-

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parent from a consideration of several forms in which it may be embodied. Such forms are shown in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

FIGURE 1 is a combined side elevational and longitudinal sectional view of a tubing anchor in a well casing, with certain anchor parts in retracted position;

FIG. 2 is an enlarged cross-section taken along the line 2—2 on FIG. 1;

FIG. 3 is an enlarged cross-section taken along the line 3—3 on FIG. 1;

FIG. 4 is a view corresponding to FIG. 1 disclosing the anchor in set position against the well casing;

FIG. 5 is an enlarged fragmentary longitudinal section of the anchoring portion of the apparatus shown in FIG. 4;

FIG. 6 is a section taken along the line 6—6 on FIG. 5;

FIG. 7 is a longitudinal section through a modified form of anchor, in set condition against the well casing;

FIG. 8 is a view similar to FIG. 7, disclosing the anchor after it has been returned forcibly to a retracted position;

FIG. 9 is an enlarged fragmentary longitudinal section through a portion of the apparatus disclosed in FIG. 7;

FIG. 10 is a cross-section taken along the line 10—10 on FIG. 9.

As disclosed in the drawings it is desired to anchor a running-in string A, such as a tubular production string, to a well casing B, to maintain the tubular production string in tension. A tension condition in the tubular string is preferred to minimize the tendency of the tubular string to reciprocate under the influence of a deep well pump (not shown), which is disposed in the tubular string at a predetermined location and which is reciprocated from the top of the hole through a string of sucker rods (not shown) connected to a suitable mechanism at the top of the well bore. To maintain the tubular string in tension, a tubing anchor C is provided.

As disclosed in the drawings, the anchor C includes a tubular main body 10 having a central passage 11 therethrough, and provided with a threaded pin 12 at its upper end threadedly secured to a coupling 13 which may be considered to be a part of the body 10 which is, in turn, attached to the lower end of a section of tubing 14 forming part of the tubular string extending to the top of the hole. The lower end of the body 10 may also be constituted as a threaded pin 15 threadedly secured to a coupling 16 which, in turn, is threadedly attached to a tubing section 17 forming part of the tubular string portion depending from the anchor C.

Encompassing the body 10 of the tool are a plurality of casing gripping members in the form of circumferentially spaced slips 18 having wickers 19 adapted to engage the wall of the well casing B to prevent upward movement of the anchor therewithin. These slips have tapered inner surfaces 20 inclined in an upward and inward direction for coaction with companion surfaces 21 on an expander 22 movably mounted on the body 10 of the tool. When the expander 22 is shifted relatively in an upward direction along the slips 18, the latter are urged outwardly and are wedged into anchoring engagement with the well casing B.

A positive slidable connection is provided between each slip 18 and the expander 22. Thus, each slip is

received within a companion slot 23 in the expander, the inner portions of the slip having outwardly directed tongues or wings 24 receivable within companion side grooves 25 extending outwardly from the expander slot. Relative upward movement of the expander 22 with respect to the slips 18 will urge the latter outwardly toward the well casing B, whereas relative downward movement of the expander with respect to the slips will cause the outer sides of the expander side grooves 25 to engage the tongue 24 and retract the slips with respect to the well casing.

The slips 18 are secured together for longitudinal movement in unison, their lateral movement being permitted by having each of their upper portions 26 provided with transverse tongues 27 receivable within companion grooves 28 in a slip ring 29 slidably mounted on the body 10 above the expander 18. The slip ring 29 has inwardly directed flanges 30 disposed within companion grooves 31 in each slip, to provide a coupling connection between each slip and the ring causing these parts to move in unison while allowing the slips 18 to slide laterally inwardly and outwardly of the slip ring. As disclosed, it is preferred to have the tongues 27, flanges 30 and grooves 28, 31 inclined to a slight extent in an upward and outward direction, whereby the force of gravity will normally tend to slide the slips downwardly and inwardly of the slip ring 29.

The slips 18 and the slip ring 29 can move longitudinally to a limited extent with respect to the body 10. Thus, downward movement of the slips and slip ring relative to the body is limited by engagement of the lower end 29a of the ring with an upwardly facing shoulder 32 on the body. On the other hand, relative upward movement of the slips 18 and slip ring 29 with respect to the body 10 is limited by a compression spring 33 encircling the body, with its upper end bearing against the coupling 13 and its lower end against a flat washer or bearing member 34 contacting the upper end of the ring 29. Usually, downward movement of the body 10 relative to the slips 18 is limited by the complete retraction of the slips along the companion expander 22, whereby the slips engage the periphery of the body below its upwardly facing shoulder.

The expander 22 is disclosed as being made integral with the body portion 35 of a drag assembly 36 that depends therefrom, this drag assembly body being tubular and terminating at its lower portion in a guide member 37 having a left-hand internal thread 38 meshing with a companion left-hand external thread 39 formed on the body 10. The body portion 35 of the drag assembly has a much smaller outside diameter than the outside diameter of the expander 22 and guide 37, providing an elongate circumferential groove 40 for the reception of circumferentially spaced drag blocks 41 adapted to frictionally engage the wall of the well casing B. The drag blocks 41 are circumferentially spaced with respect to one another by a stop sleeve 42, 42a encompassing the drag body 35. This stop sleeve is made in two halves 42, 42a, which fit around the body portion 35 of the drag device 36 with their upper and lower flanges 43 received within companion recesses 44 in the lower portion of the expander 22 and the upper part of the guide 37, the flanges and recesses being of such radial distance as to preferably dispose the outer surface of the sleeve 42, 42a substantially flush with the outer surfaces of the expander and the guide. The two sleeve halves 42, 42a are secured to the body portion 35 of the drag assembly by cap screws 45 extending through the inwardly directed sleeve flanges 43 and threaded into the body portion 35.

The part of the sleeve between its upper and lower flanges 43 has an inside diameter 46 that is much greater than the outside diameter of the body portion 35 of the drag assembly, providing the annular space or groove 40 in which the inner portions of the drag blocks 41 are located. Each drag block projects through an elongate

slot or window 47 in the sleeve 42, 42a which is slightly longer than the drag block, the intermediate portion 41a of each drag block frictionally engages the wall of the well casing B, the friction force being provided by one or a plurality of helical compression springs 48 disposed in sockets 49 in each drag block and bearing against the body portion 35 of the drag assembly and the bases of the socket. Outward movement of each drag block under the influence of the springs 48 is limited by engagement of the upper and lower termini 50 of each drag block with the inner surface of the sleeve 42, 42a at the upper and lower ends of the slot 47.

The frictional engagement of the drag blocks 41 against the well casing B tends to resist both longitudinal movement and rotation of the expander 22 in the well casing. Because of such resistance to turning of the expander 22 and, for that matter, of the slips 18 slidably coupled thereto, the body 10 can be turned in either direction, which will effect a relative longitudinal feeding of the body 10 with respect to the expander 22, depending upon the direction of rotation of the body. Thus, if the tubular string A and the body 10 are turned to the left, the body 10 will move relatively downward along the expander 22, or, conversely, the expander will move upwardly relative to the body, the corresponding upward movement of the slips 18 being resisted by the helical compression spring 33, resulting in the expander moving upwardly within the slips and shifting the latter radially outward into anchoring engagement with the wall of the well casing B. The slips 18 can shift upwardly to a limited extent to compress the spring 33 to a greater extent than the amount of compression that it possesses with the slip ring engaging the upwardly facing body shoulder 32. Rotation of the tubular string A and the body 10 in a right-hand direction will result in relative upward feeding of the body 10 with respect to the expander 22 and the slips 18, or a relative downward movement of the expander 22 along the body, the slips 18 being prevented from moving downwardly when the slip ring 29 engages the body shoulder 32, whereupon the tongue and groove connection 24, 25 between the expander and the slips will shift the slips inwardly to their fully retracted position.

The threads 38, 39 may be maintained free from foreign substances in the well casing by a wiper or seal ring 52 in an internal groove 53 in the expander 22 slidably and sealingly engaging the periphery of the body 10, and also by securing a sleeve or shield 54 to the guide 37, as by means of cap screws 55, the lower end of the shield terminating in an inwardly directed flange 56 extending to the periphery of the body 10. This flange 56 is preferably made relatively thin, and the shield 54 and flange 56 are made of a fractureable material, enabling the flange to shear off in the event foreign substances enter the shield during movement of the anchoring tool C in the well casing. Foreign substances in the well casing can also be forestalled from settling downwardly between the slip ring 29 and the body 10 of the tool by a seal ring 57, such as a rubber or rubber-like O ring, in a groove 58 in the upper portion of the slip ring, which sealingly and slidingly engages the periphery of the body.

In the use of the apparatus C described and disclosed in the drawings, the expander 22 initially occupies a lower position on the body, with the slips 18 fully retracted, as disclosed in FIG. 1. The tool is lowered in the well casing by means of the tubing string A, the drag blocks 41 sliding along the wall of the well casing B. In view of the threaded connection 38, 39 between the body and the drag device, relative movement of the expander 22 along the body 10 cannot occur. The slip ring 29 cannot move upwardly relative to the body 10, inasmuch as the slips 18 are retracted and engage the periphery of the body. Because of the inclination of the grooves 28, and of the tongues 27 and flanges 30 at the upper end of the slips 18, the latter tend to stay inwardly under the

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influence of gravity. They are also held inwardly by their tongue and groove connections 24, 25 with the expander.

After the apparatus has been lowered in the well casing B to the point at which the anchor C is to be set, the tubular string A is rotated to the left, correspondingly rotating the body 10 to the left. The frictional engagement of the drag blocks 41 against the well casing prevents rotation of the drag body 35 and expander 22, and also of the slips 18 and slip ring 29, since the slips are coupled to the expander. As a result, the body 10 will feed downwardly along the expander 22, acting through the spring 33 to shift the slip ring 29 and the slips 18 downwardly with respect to the expander 22, causing the slips to shift outwardly into engagement with the wall of the well casing B. When the slips 18 engage the well casing, the body 10 can move down to an additional extent to compress the spring 33. However, the downward movement of the body 10 relative to the expander 22 is limited by a positive stop. Such stop includes a pin 60 secured to the drag body 35, which is engageable with a stop lug 61 secured to the body. Thus, when the inner tubular body 10 threads downwardly within the drag device, the stop lug 61 will eventually engage the stop pin 60 and preclude further downward threading of the tubular body 10 with respect to the drag device 36, which will positively limit the amount that the spring 33 can be compressed, and which will prevent further downward relative movement between the several parts of the apparatus. Actually, the initial position of the tubular body 10 with respect to the drag device 36, when the slips 18 are in their retracted position, is also positively determined by engagement of a lower stop lug 62 with the stop pin 60 on the drag body.

After the slips 18 have been expanded outwardly, as described above, an upward strain can be taken on the tubular string A and the tubular body 10, such upward pull being transferred through the left-hand threaded connection 38, 39 to the drag body 35 and the expander 22, to anchor the slips 18 more firmly against the well casing. Inasmuch as the apparatus is designed primarily for use in pumping wells, should the reciprocation of the pump tend to elongate the tubular string A, such elongating movement will carry the tubular body 10, the drag assembly 36 and expander 22 downwardly, the spring 33 acting on the slip ring 29 and the slips 18 to slide the slips downwardly along the casing wall. As a result, the slips 18 and the expander 22 move as a unit down along the casing. In the event of the body tending to move up within the casing, such upward movement is resisted by the immediate wedging of the expander 22 behind the slips 18, to urge their wickers 19 into the casing wall. Thus, the tendency of the tubular string A to "breathe" or reciprocate as the deep well pump reciprocates is prevented, since the apparatus C will always permit its movement in a downward direction, but will not permit it to move back in an upward direction. Accordingly, the anchor C shifts down as a unit within the well casing to occupy a progressively lower position, until the tension in the tubular string is such as to preclude any further downward stretching of the tubular string A.

With the anchor in set position in the well casing, should the temperature of the tubular string increase, as, for example, due to the higher temperature of the well production flowing through the string, it would tend to elongate. Since the production string is usually anchored at the top of the well bore, the elongation would take place in a downward direction. Such downward movement would result in a downward shifting of the anchor as a unit in the manner described above, to locate the slips 18 and expander 22 in a downward direction, but precluding return or upward movement of the expander 22 from its lowered, anchored position.

In the event the anchor C is to be released from the well casing B, for the purpose of removing the tubular string

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from the latter, it is only necessary to rotate the tubular string to the right, such right-hand rotation will result in a relative upward threading of the tubular body 10 within the drag device 36, because of the left-hand threaded connection 38, 39, the drag device, expander 22 and slips 18 being prevented from turning by the frictional engagement of the drag device against the well casing. The upward feeding of the tubular body 10 will cause the shoulder 32 to engage the slip ring 29, urging the slips 18 in an upward direction and causing a relative downward movement of the expander 22 along the body 10 and the slips, the slips thereby being shifted by the tongue and groove connection 24, 25 to a fully retracted position, such as disclosed in FIG. 1. The relative right-hand rotation between the tubular body 10 and the drag device 36 is limited by engagement of the stop element 62 on the tubular body with the stop pin 60 secured to the drag device.

The anchor C can now be elevated in the well casing without any danger of setting the slips 18 against the casing B, since the latter cannot shift outwardly. This is due to the positive holding of the expander in its lower position with respect to the body, and because of the inability of the slip ring 29 and slips 18 to shift downwardly relative to the body by virtue of engagement of the slip ring 29 with the body shoulder 32. The tubular string A and the anchor C can now be elevated in the well casing and removed therefrom, if desired.

Assuming the anchor to be in the retracted position disclosed in FIG. 1 and that sand, detritus and other foreign substances may have entered the sand shield 54, such foreign substances will not prevent relative downward movement of the body 10 with respect to the drag device 36 and expander 22 in setting the slips 18 against the casing. The downward force exerted by the threaded portion 39 of the body upon the sand or detritus will cause the flange 56 of the shield to be broken off, allowing the threaded portion 39 to force the sand out of the shield.

It is, accordingly, apparent that a tubing anchor has been provided to automatically compensate for elongation in the tubular string A, the expander portion 22 of the apparatus remaining in intimate engagement with the slips 18 during downward movement or elongation of the tubular string as a result of temperature increase, or as a result of operation of a deep well pump. The use of the friction drag device 36 in resisting downward movement of the expander 22, and the fact that the expander must move downwardly with the tubular body 10 and the tubular string A, coupled with the fact that the slips 18 are caused to follow up closely against the expander, prevents any material separation from occurring between the expander and the slips. Accordingly, the tendency for the tubular string A and the tubular body 10 to move upwardly does not permit the expander 22 to pound back into the slips 18, and hammer the latter against the wall of the well casing. The expander can move only an exceedingly slight distance upwardly with respect to the slips when the tubular string and body tend to shift in an upward direction as a result of the reciprocations of the pump. The anchor C automatically shifts in a downward direction to take up any play or slack in the tubular string, but it will not permit return or upward movement of the body 10 of the tool and of the tubular string A. Even if a preliminary tension is not taken on the tubular string A, after the anchor C has been set in the well casing B, such tension will be achieved automatically as a result of the reciprocation of the tubular string under the action of the deep well pump. The tubular string can move downwardly under the action of the pump, but it can move back upwardly. There will be an intermittent downward feeding of the tubular string A, with no return movement being permitted.

In the form of invention disclosed in FIGS. 7 to 10, inclusive, essentially the same tubing anchor is rep-

represented as shown in FIGS. 1 to 6, inclusive. However, as shown in FIGS. 7 to 10, inclusive, a safety feature has been incorporated in the tool to enable the slips 18 to be retracted in the event difficulty is encountered in rotating the tubular string A and body 10 to the right, in order to elevate the body with respect to the drag device 36a and the expander 22, or, conversely, to effect a lowering of the expander along the body, which will insure retraction of the slips.

The safety device includes a guide or housing 37a which forms the lower part of the drag device 36a, this guide or housing being spaced outwardly from the external left-hand thread 39 on the body, to provide an annular chamber 80 in which a nut 81 is disposed. This nut has internal left-hand threads 38 meshing with the external left-hand threads 39 on the body, and is prevented from turning relative to the drag guide or housing 37a by a screw or key 82 received in the housing and disposed within a longitudinal keyway 83 formed in the exterior of the nut 81. The nut is prevented from moving downwardly out of the housing 37a by a nut retainer 84 threaded into the lower end of the guide or housing 37a. The sand shield 54 may be formed integral with this retainer 84, possessing the inwardly directed flange 56 described in connection with the other form of the invention. Initially, upward movement of the nut 81 relative to the housing is prevented by a shear ring 85 disposed within a circumferential recess 86 in the outer upper corner of the nut. This shear ring has a relatively thin outer portion 87 located within a circumferential internal groove 88 in the housing 37a, the inner portion of the shear ring bearing against the inner wall 89 of the housing.

When the screw or key 82 is disposed in the keyway 83, and the shear ring 85 is intact, with its thin outer portion 87 disposed in the housing groove 88, and with the nut retainer 84 threaded into place in engagement with the lower end of the nut 81, the latter is prevented from moving in both longitudinal directions with respect to the guide or housing 37a, and is also prevented from rotating with respect thereto. Accordingly, the nut 81 and housing 37a function in the same manner as the guide 37 and internal left-hand threads 38 in the other form of the invention in effecting setting of the slips 18 against the well casing B, and also in effecting retracting of the slips therefrom as a result of rotating the body 10 to the right with respect to the drag device 36a, the expander 22 integral therewith, and the slips 18. If the body 10 of the tool cannot be rotated with respect to the drag device 36a and expander 22, in order to retract the slips 18 from the anchored position and condition disclosed in FIG. 7, an upward strain is taken on the tubing string A and the body. Since the slips 18 are anchored against the well casing B, the expander 22 and drag device 36a can move upwardly. The upward pull or strain is transmitted from the body 10 to the nut 81, and through the shear ring 85 to the guide or housing portion 37a of the drag device and the expander. When the strain exceeds the shear strength of the outer portion 87 of the shear ring, which is disposed within the internal groove 88 in the housing, such outer portion is disrupted or broken away from the thicker, inner portion of the shear ring, which then frees the nut 81 and body 10 from the guide or housing (FIG. 8). The body 10 can then move upwardly relative to the guide or housing 37a, the nut shifting in an upward direction within the annular space 80 between the body and the housing. After the body 10 has moved upwardly to a slight extent, its shoulder 32 engages the lower end of the slip ring 29, whereupon the upward pull is transmitted to the slips 18 to urge them in an upward direction, in which they will shift inwardly of the expander 22, because of the tongue and groove interconnection 24, 25 therebetween. The body 10 can continue to move upwardly within the drag device 36a and expander 22 to the extent limited by engagement of the slips 18 with the periphery of the

body, whereupon the upward force exerted on the body will be transmitted through the slip ring 29 and slips 18 to the expander 22 and drag device 36a, to urge the latter upwardly along the wall of the well casing B. If desired, the nut 81 is moved completely off the screw or key 82, so as to uncouple the nut from the housing 37a. Such action will then permit the tubing string A and body 10 to be rotated, if desired.

In the normal use of the anchor disclosed in FIGS. 7 to 10, inclusive, the nut 81 remains attached to the guide or housing 37a against both rotational and longitudinal movement with respect thereto, so that turning of the body 10 of the tool to the left will cause the expander 22 to anchor the slips 18 against the casing B, whereas turning of the body to the right will effect a retraction of the slips, so that the anchor C can be removed from the well casing or shifted to another location therewithin. It is only when the rotational movement of the body 10 to the right in effecting release of the slips cannot occur that it is necessary to take the required amount of upward strain on the tubing string A and body to shear the ring 85 and cause the body 10 to move longitudinally and without rotation within the expander 22 to a condition in which the shoulder 32 engages the slip ring 29 to elevate the slips 18 relative to the expander 22 and move them to retracted position. It is to be noted that when the slips 18 are anchored against the well casing, the body shoulder 32 is spaced a slight distance from the lower end of the slip ring 29. This permits the shear ring 85 to be disrupted before the shoulder 32 engages the slip ring 29.

The inventor claims:

1. In apparatus to be disposed within and anchored to a well conduit; a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin; expander means on said body adapted to coact with said slip means to expand and hold said slip means against the well conduit; drag means connected to said expander means and movable longitudinally therewith both before and after said slip means have been expanded against the well conduit and frictionally engageable with the well conduit to resist movement of said expander means therewithin; said body being rotatable within said expander means; and means interconnecting said body and expander means whereby rotation of said body within said expander means moves said expander means longitudinally relative to said body and slip means to cause said expander means to shift said slip means laterally of said body.
2. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin; expander means connected to said body to move longitudinally therewith as a unit and without relative motion therebetween when said slip means engages the well conduit and adapted to coact with said slip means to expand and hold said slip means against the well conduit; drag means connected to said expander means and movable longitudinally therewith both before and after said slip means have been expanded against the well conduit and frictionally engageable with the well conduit; and means on said body engageable with said slip means to resist movement of said slip means away from said expander means whereby longitudinal movement of said expander means toward said slip means expands said slip means against the well conduit.
3. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin; expander means on said body and adapted to coact with said slip means to expand and hold said slip means against the well conduit; drag means connected to said expander

able longitudinally therewith both before and after said slip means have been expanded against the well conduit and frictionally engageable with the well conduit to resist movement of said expander means therewithin; and means threadedly interconnecting said body and expander means whereby rotation of said body moves said expander means upwardly relative to said body and slip means to shift said slip means laterally outward into engagement with the well conduit.

12. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin against upward movement; expander means on said body movable upwardly with respect to said slip means to expand and hold said slip means against the well conduit; drag means connected to said expander means and movable longitudinally therewith both before and after said slip means have been expanded against the well conduit and frictionally engageable with the well conduit to resist movement of said expander means therewithin; means threadedly interconnecting said body and expander means whereby rotation of said body moves said expander means upwardly relative to said body and slip means to shift said slip means laterally outward into engagement with the well conduit; and means engaging said slip means to yieldably urge said slip means downwardly of said body toward said expander means to maintain said slip means engaged with the well conduit.

13. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by said body and adapted to engage the well conduit to anchor the body therewithin; expander means on said body adapted to coact with said slip means to expand and hold said slip means against the well conduit; drag means connected to said expander means both before and after said slip means have been expanded against the well conduit and frictionally engageable with the well conduit to resist movement of said expander means therewithin; means threadedly interconnecting said body and expander means whereby rotation of said body moves said expander means relative to said body and slip means to shift said slip means laterally of said body; and spring means engaging said body and slip means to yieldably urge said slip means toward said expander means to maintain said slip means engaged with the well conduit.

14. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by said body and adapted to engage the well conduit to anchor the body therewithin against upward movement; expander means on said body movable upwardly with respect to said slip means to expand and hold said slip means against the well conduit; drag means connected to said expander means both before and after said slip means have been expanded against the well conduit and frictionally engageable with the well conduit to resist movement of said expander means therewithin; means threadedly interconnecting said body and expander means whereby rotation of said body moves said expander means upwardly relative to said body and slip means to shift said slip means laterally outward into engagement with the well conduit; and spring means engaging said body and slip means to yieldably urge said slip means downwardly toward said expander means to maintain said slip means in engagement with the well conduit.

15. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by said body and adapted to engage the well conduit to anchor the body therewithin against upward movement; expander means on said body movable upwardly with respect to said slip means to expand and hold said slip means against the well conduit; drag means connected to said expander means both before and after said slip means have been expanded against the well conduit and frictionally engageable with the well conduit to resist movement of said expander

means therewithin; means threadedly interconnecting said body and expander means whereby rotation of said body moves said expander means upwardly relative to said body and slip means to shift said slip means laterally outward into engagement with the well conduit; spring means engaging said body and slip means to yieldably urge said slip means downwardly toward said expander means to maintain said slip means in engagement with the well conduit; and stop means on said body engageable by said slip means to limit downward movement of said slip means by said spring means with respect to said body.

16. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin; expander means on said body adapted to coact with said slip means to expand and hold said slip means against the well conduit; drag means connected to said expander means and movable longitudinally therewith both before and after said slip means have been expanded against the well conduit and frictionally engageable with the well conduit to resist movement of said expander means therewithin; said body being rotatable within said expander means; and means interconnecting said body and expander means whereby rotation of said body within said expander means moves said expander means longitudinally relative to said body and slip means to cause said expander means to shift said slip means laterally of said body; said interconnecting means including a releasable connection which, when released, permits said body to move longitudinally and without rotation relative to said expander means.

17. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin; expander means on said body adapted to coact with said slip means to expand and hold said slip means against the well conduit; drag means connected to said expander means and movable longitudinally therewith both before and after said slip means have been expanded against the well conduit and frictionally engageable with the well conduit to resist movement of said expander means therewithin; said body being rotatable within said expander means; and means interconnecting said body and expander means whereby rotation of said body within said expander means moves said expander means longitudinally relative to said body and slip means to cause said expander means to shift said slip means laterally of said body; said interconnecting means including a frangible connection adapted to be disrupted in response to a predetermined force which is imposed on said body to permit said body to move longitudinally and without rotation relative to said expander means.

18. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin; expander means on said body adapted to coact with said slip means to expand and hold said slip means against the well conduit; drag means connected to said expander means and movable longitudinally therewith both before and after said slip means have been expanded against the well conduit and frictionally engageable with the well conduit to resist movement of said expander means therewithin; and means threadedly interconnecting said body and expander means whereby rotation of said body moves said expander means relative to said body and slip means to shift said slip means laterally of said body; said interconnecting means including a releasable connection which, when released, permits said body to move longitudinally and without rotation relative to said expander means.

19. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted

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to engage the well conduit to anchor the body therewithin; expander means on said body adapted to coact with said slip means to expand and hold said slip means against the well conduit; drag means connected to said expander means and movable longitudinally therewith both before and after said slip means have been expanded against the well conduit and frictionally engageable with the well conduit to resist movement of said expander means there-within; and means threadedly interconnecting said body and expander means whereby rotation of said body moves said expander means relative to said body and slip means to shift said slip means laterally of said body; said inter-connecting means including a frangible connection adapted to be disrupted in response to a predetermined force imposed on said body to permit said body to move longitudinally and without rotation relative to said expander means.

20. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin; expander means on said body adapted to coact with said slip means to expand and hold said slip means against the well conduit; means for transmitting longitudinally directed force on said body directly to said expander means whereby said slip means is held in anchoring engagement with the well conduit, said transmitting means coupling said body to said expander means to prevent relative longitudinal movement between said body and expander means during raising and lowering of the apparatus in the well conduit; means engaging said body and slip means to yieldably urge said slip means toward said expander means to maintain said slip means engaged with the well conduit; and means on said body engaged by said yieldable means to limit movement of said slip means away from said expander means whereby relative longitudinal movement of said expander means towards said slip means anchors said slip means against the well conduit.

21. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin; expander means on said body adapted to coact with said slip means to expand and hold said slip means against the well conduit; means for transmitting longitudinally directed force on said body directly to said expander means whereby said slip means is held in anchoring engagement with the well conduit, said transmitting means coupling said body to said expander means to prevent relative longitudinal movement between said body and expander means during raising and lowering of the apparatus in the well conduit; spring means engaging said body and slip means to yieldably urge said slip means toward said expander means to maintain said slip means engaged with the well conduit; and means on said body engaged by said spring means to limit movement of said slip means away from said expander means whereby relative longitudinal movement of said expander means toward said slip means anchors said slip means against the well conduit.

22. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin against upward movement; expander means on said body adapted to coact with said slip means to expand and hold said slip means against the well conduit; means for transmitting upwardly directed force on said body directly to said expander means whereby said slip means is held in anchoring engagement with the well conduit, said transmitting means coupling said body to said expander means to prevent relative longitudinal movement between said body and expander means during raising and lowering of the apparatus in the well con-

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duit; means engaging said body and slip means to yieldably urge said slip means downwardly toward said expander means to maintain said slip means engaged with the well conduit; and means on said body engageable by said yieldable means to limit upward movement of said slip means away from said expander means whereby relative upward movement of said expander means toward said slip means anchors said slip means against the well conduit.

23. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin against upward movement; expander means on said body adapted to coact with said slip means to expand and hold said slip means against the well conduit; means for transmitting upwardly directed force on said body directly to said expander means whereby said slip means is held in anchoring engagement with the well conduit, said transmitting means coupling said body to said expander means to prevent relative longitudinal movement between said body and expander means during raising and lowering of the apparatus in the well conduit; spring means engaging said body and slip means to yieldably urge said slip means downwardly toward said expander means to maintain said slip means engaged with the well conduit; and means on said body engageable by said spring means to limit upward movement of said slip means away from said expander means whereby relative upward movement of said expander means toward said slip means anchors said slip means against the well conduit.

24. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin; expander means on said body adapted to coact with said slip means to expand and hold said slip means against the well conduit; means for shifting said expander means and slip means longitudinally with respect to each other to expand and hold said slip means against the well conduit, said shifting means including yieldable instrumentalities engaging said body and slip means to yieldably urge said slip means toward said expander means; means engageable with said body and expander means for transmitting longitudinally directed force imposed on said body directly from said body to said expander means whereby said slip means is held in anchoring engagement with the well conduit, said transmitting means including a releasable connection which, when released, permits said body to move longitudinally and without rotation relative to said expander means; and means on said body engageable with said slip means, after release of said connection, to shift said slip means longitudinally of said expander means and to retracted position.

25. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin against upward movement; expander means on said body adapted to coact with said slip means to expand and hold said slip means against the well conduit; means for shifting said expander means and slip means longitudinally with respect to each other to expand and hold said slip means against the well conduit, said shifting means including yieldable instrumentalities engaging said body and slip means to yieldably urge said slip mean downwardly toward said expander means; means engageable with said body and expander means for transmitting upwardly directed force imposed on said body directly from said body to said expander means whereby said slip means is held in anchoring engagement with the well conduit, said transmitting means including a releasable connection which, when released, permits said body to move upwardly and without rotation relative to said expander means; and means on said body engageable with said slip means, after

release of said connection, to shift said slip means upwardly of said expander means and to retracted position.

26. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin; expander means on said body adapted to coact with said slip means to expand and hold said slip means against the well conduit; means for shifting said expander means and slip means longitudinally with respect to each other to expand and hold said slip means against the well conduit, said shifting means including yieldable instrumentalities engaging said body and slip means to yieldably urge said slip means toward said expander means; means engageable with said body and expander means for transmitting longitudinally directed force imposed on said body directly from said body to said expander means whereby said slip means is held in anchoring engagement with the well conduit, said transmitting means including a frangible connection adapted to be disrupted in response to a predetermined force which is imposed on said body to permit said body to move longitudinally and without rotation relative to said expander means; and means on said body engageable with said slip means, after disruption of said connection, to shift said slip means longitudinally of said expander means and to retracted position.

27. In apparatus to be disposed within and anchored to a well conduit: a body; slip means carried by and movable longitudinally with respect to said body and adapted to engage the well conduit to anchor the body therewithin against upward movement; expander means on said body adapted to coact with said slip means to ex-

pand and hold said slip means against the well conduit; means for shifting said expander means and slip means longitudinally with respect to each other to expand and hold said slip means against the well conduit, said shifting means including yieldable instrumentalities engaging said body and slip means to yieldably urge said slip means downwardly toward said expander means; means engageable with said body and expander means for transmitting upwardly directed force imposed on said body directly from said body to said expander means whereby said slip means is held in anchoring engagement with the well conduit, said transmitting means including a frangible connection adapted to be disrupted in response to a predetermined upward force which is imposed on said body to permit said body to move upwardly and without rotation relative to said expander means; and means on said body engageable with said slip means, after disruption of said connection, to shift said slip means upwardly of said expander means and to retracted position.

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