

Nov. 18, 1952

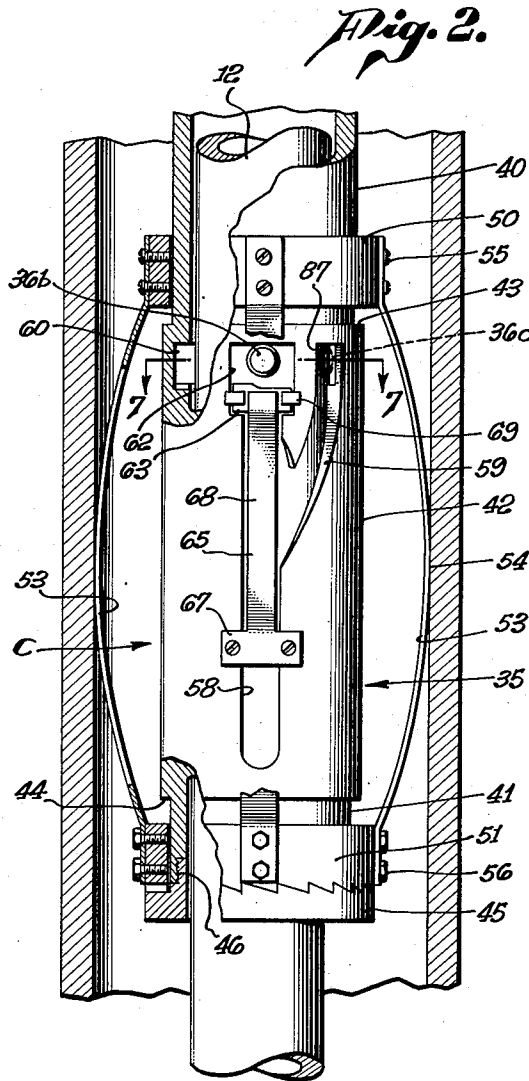
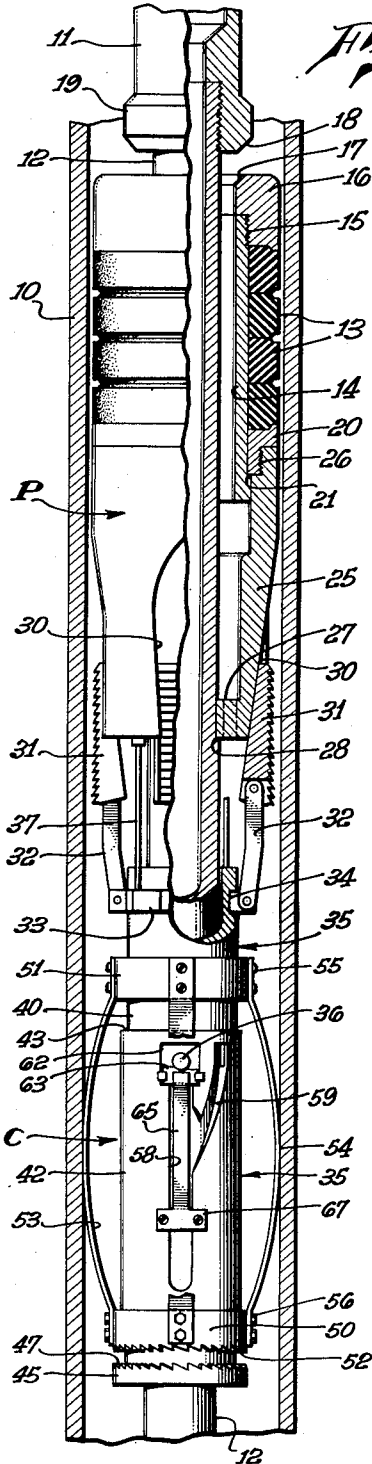
G. MEYER

2,618,342

CONTROL DEVICE FOR WELL TOOLS

Filed Sept. 3, 1946

3 Sheets-Sheet 1



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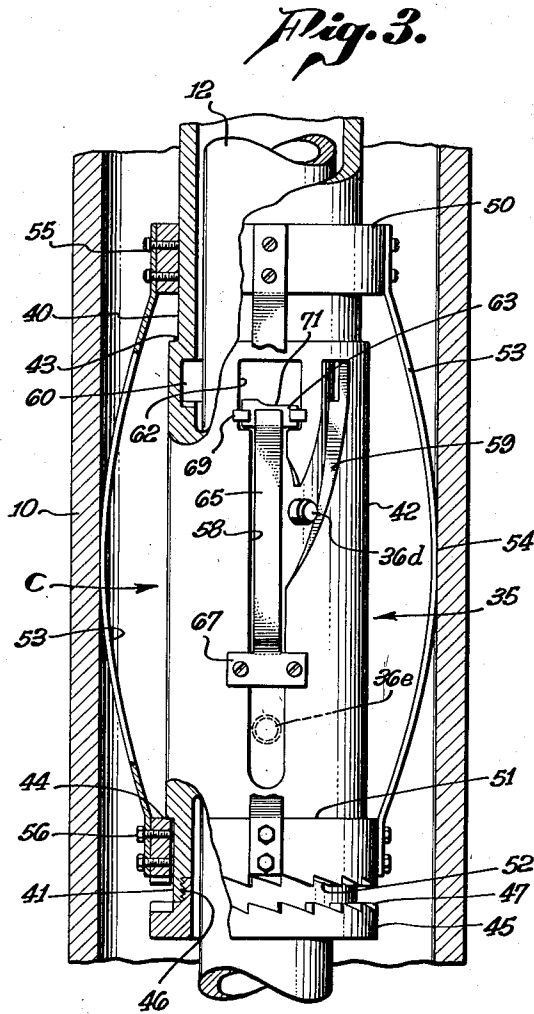
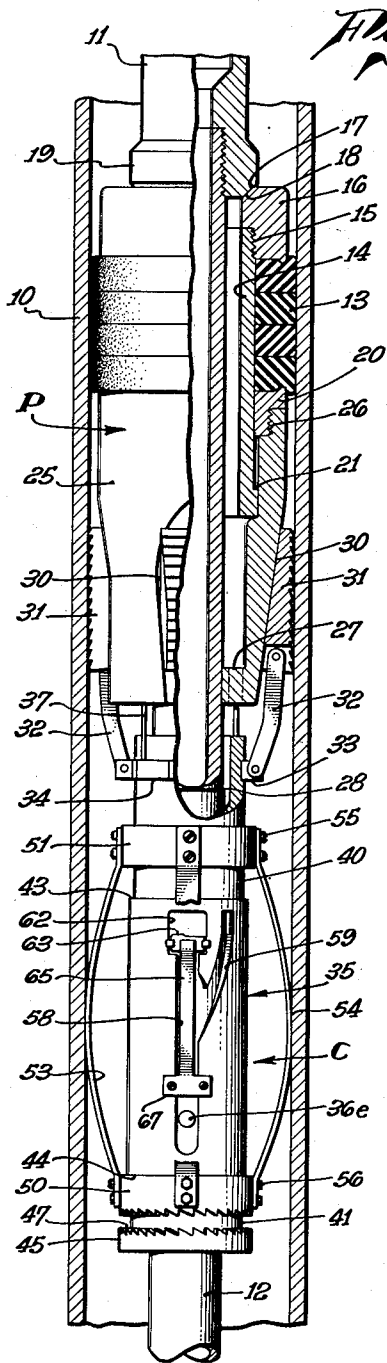
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3 Sheets-Sheet 2



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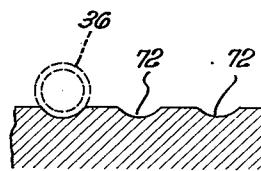
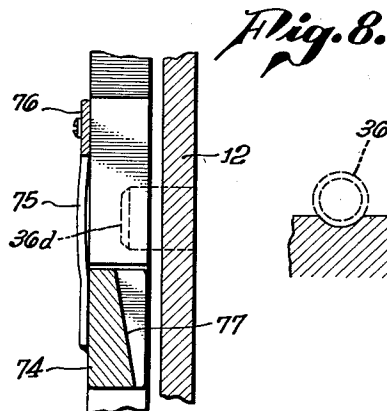
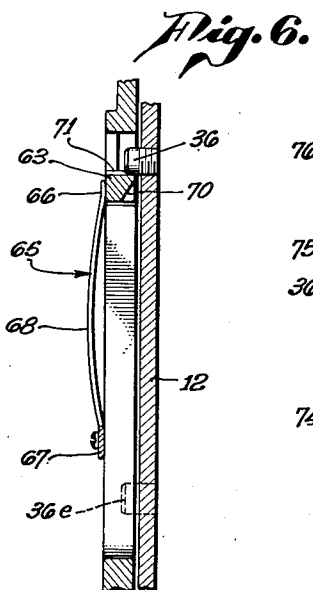
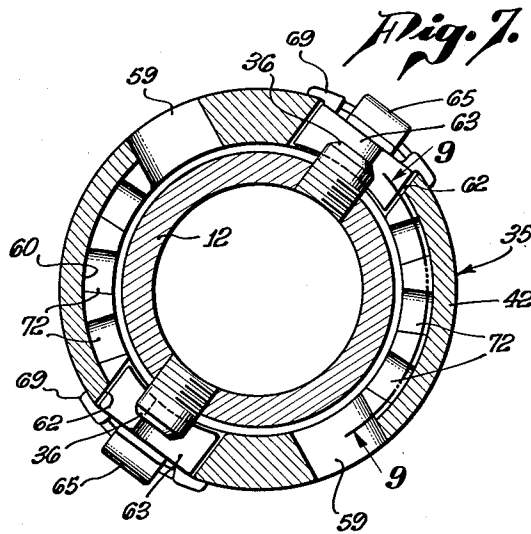
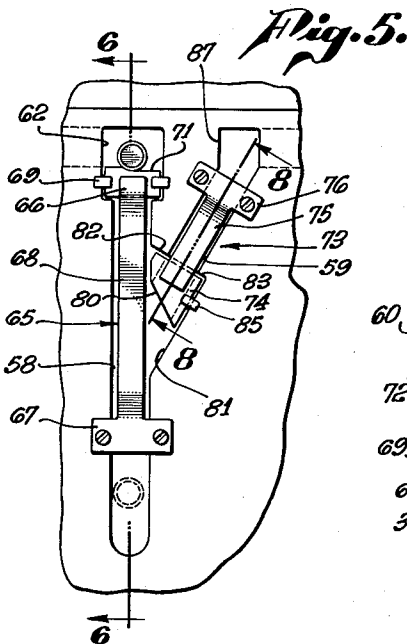
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CONTROL DEVICE FOR WELL TOOLS

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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CONTROL DEVICE FOR WELL TOOLS

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Application September 3, 1946, Serial No. 694,471

14 Claims. (Cl. 166—12)

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This invention relates to well apparatus and more particularly to control devices for such apparatus designed for remote sub-surface actuation and manipulation in well bore holes.

Control devices have long been used in connection with a variety of tools and apparatus designed for subsurface operations and installations in well bore holes. One of the best known of such control devices is the so-called J pin and slot arrangement employed in connection with the control cage apparatus usually associated with various types of packers, liner hangers, and the like devices. Such J pin slot types of control means and the like lock and latch mechanisms are usually employed to position and to maintain certain elements of the apparatus or tool in given relative positions at certain times such as that, for example, required during the running-in of a given tool into the well casing, and the subsequent manipulation thereof while in a remote location within the well to release certain elements required to permit a given action or operation in the well, such as, for example, to set the slips of a packer or liner, control a valve, or other flow device, or fire a perforator gun.

In control devices, such as the J pin and slot latching mechanism as heretofore employed in connection with hook wall type of packers, for example, it has been more or less conventional practice to design such apparatus to be actuated by turning the running-in tubing string or pipe upon which the tool is suspended in the well bore hole to the right and to the left to respectively place it in the latched and unlatched condition. The reverse order of action may obtain in certain cases, but, in any event, with the conventional latching mechanism, it is usually necessary to turn the tubing or drill string to the left at some stage of the manipulation thereof in the well. The tubing or drill pipe strings upon which such apparatus are suspended are usually made up of sections coupled together by right-hand threaded joints. Less frequently, left-hand threaded joints may be employed for certain purposes, but regardless of the type of the threaded connections employed, whether right-hand or left-hand, the turning of the tubing string in the direction opposite to the hand of the threads employed in the couplings is necessary at some stage of the manipulation of the conventional J slot type of control device, and this tends to unscrew the joints and may possibly result in the disconnection of one or more of the tubing or drill pipe sections. The turning of the tubing or drill pipes counter to the threaded couplings is particularly dangerous in

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a crooked well bore hole or under other conditions which impose relatively high frictional resistance to the rotation of the tubing or pipe. Many long and costly fishing operations have resulted from the disconnection of couplings under the foregoing conditions.

It is, therefore, an object of the present invention to eliminate the hereinbefore mentioned dangers by providing a well apparatus control device which can be actuated throughout its full cycle of operation without the necessity for turning the tubular string or drill pipe upon which it is suspended in a direction tending to loosen or unscrew the couplings.

It is another object of the present invention to provide a well apparatus control device which can be actuated throughout its full cycle of operative steps by rotation of the tubing or drill pipe string in one direction only.

A still further object of the invention is to provide a well apparatus control device similar to the conventional J type of latching device in which the parts can be actuated between latched and unlatched position by means of rotation of the tubular supporting string in one direction only.

Other objects, advantages, and features of novelty will be evident hereinafter.

In the drawings, which show by way of illustration preferred embodiments of the invention and in which like reference numerals designate the same or similar parts throughout the several views:

Figure 1 is a longitudinal view partially in elevation and partially in section illustrating the general assembly of the apparatus of the invention as it may be employed in connection with a conventional well casing packer and showing its appearance while being run into a well casing prior to setting.

Figure 2 is an enlarged, longitudinal section of the control device portion of Figure 1, showing one phase in its operation.

Figure 3 is a view of the same apparatus as that shown in Figure 2 but showing another phase in its operation.

Figure 4 is a view of the same apparatus illustrated in Figure 1, but showing its appearance after being set in a well casing.

Figure 5 is a fragmentary, detail development of the control device slot arrangement of Figures 2 and 3 and showing an added modification thereto.

Figure 6 is a fragmentary, longitudinal section taken on line 6—6 of Figure 5.

Figure 7 is a cross-sectional view taken on line 7—7 of Figure 2.

Figure 8 is an enlarged fragmentary sectional view taken on line 8—8 of Figure 5.

Figure 9 is an enlarged developed sectional view taken on line 9—9 of Figure 7.

Referring now primarily to Figures 1 and 2, the type of well packer which is shown at P, by way of illustration, in connection with the control device C of this invention, is substantially identical to that shown and described in the patent issued to Renouf, No. 2,005,955, issued June 25, 1935. The beforementioned well packer P is adapted to be run into a well bore or casing 10 on the end of a suitable pipe or tubing string which may be attached through a suitable coupling, as shown at 11, to the upper end of the tubular mandrel 12 of the packer. The mandrel 12 extends through the packer P and downward therefrom through the packer setting control and cage assembly C which contains the preferred embodiment of this invention.

The well packer P, supported from the tubing and positioned around the mandrel 12 as hereinbefore mentioned, comprises briefly, a plurality of annular packer rings as shown at 13 encircling a cylindrical or tubular packer ring sleeve 14 which is, in turn, threadedly coupled at 15 at its upper end to a packer valve seat member 16. The upper, inner edge of the valve seat member 16 is provided with a bevelled surface 17 adapted to receive in sealing engagement the lower bevelled surface 18 of a valve head 19. The valve head 19 is formed integrally with the beforementioned coupling 11 which is suspended from the tubing as hereinbefore mentioned.

An annular retaining nut 20 is slidably positioned around the lower end of the packing ring sleeve 14 and is retained thereon at its lowermost position as shown, by means of an offset annular shoulder 21 formed at the lower end of the sleeve. The lower, annular surface of the valve seat member 16, and the upper annular surface of the retaining nut 20, serve as means for applying longitudinal compressive force to the packer rings 13 to deform or expand them into sealing position between the packer sleeve 14 and a surrounding casing.

A slip expander 25 is threadedly connected at 26 with the beforementioned retaining nut 20 and is longitudinally slidably supported on the mandrel 12 and concentrically guided thereon by means of a perforate spider element 27 which, in turn, when the packer is unset, rests upon and is supported by an offset annular shoulder 28 formed at an intermediate section of the said mandrel.

The slip expander 25 is provided with a plurality of sloping, dove-tailed slip guides as shown at 30 adapted to slidably retain and support in each, a wedge-shaped wickered slip as shown at 31. Each of the slips 31 is linked by means of a slip rein 32 to a slip rein ring 33 which is, in turn, rotatably retained within an external, annular groove as shown at 34 formed near the upper end of a cylindrical cage sleeve 35. The cage sleeve 35 is carried on the lower end portion of the beforementioned mandrel 12, with freedom for concentric or coaxial rotational and longitudinal sliding motion thereon, except for the limitations in direction and extent of such slidable motion relative to the mandrel which are imposed upon it, as hereinafter more fully described, by a pair of setting pins or guide members 36 which are fixed at diametrically opposite

positions in the mandrel, as best shown in Figure 7, and which are adapted to move in guide slots formed in the cage sleeve 35.

The lowermost position of the cage sleeve 35 relative to the slip expander is also determined by means of a plurality of longitudinally disposed interconnecting hold-down bolts 37 which are threaded into the upper side of the slip rein ring 33, and extend upward into cylindrical recesses in the lower end of the slip expander 25 with limited freedom for longitudinal sliding motion therein sufficient for the required setting movement of the slips relative to the slip expander, as is more fully shown and described in the hereinbefore mentioned Renouf Patent No. 2,005,955.

The packer slip control and cage assembly C which embodies in its construction the specific features of the invention, comprises the beforementioned tubular cage sleeve 35 which is shaped with upper and lower sections 40 and 41, respectively, of reduced external diameter as compared to an intermediate portion 42, thereby forming at the points of change of diameter oppositely facing annular shoulders as shown at 43 and 44. A clutch flange 45 is fastened at threads 46 to the lower end of the lower section 41 of the cage sleeve. The upper exposed annular face of said flange opposite the beforementioned sleeve shoulder 44, is provided therearound with a plurality of upwardly facing serrations forming an annular ratch, as shown at 47.

A pair of cage spring collars 50 and 51 are retained in encircling position with limited freedom for longitudinal sliding motion upon the beforementioned upper and lower sections 40 and 41, respectively, of the cage sleeve 35 adjacent the shoulders 43 and 44. The lower collar 51 is retained with limited freedom for longitudinal sliding motion between the shoulder 44 and the flange 45, upon the lower section 41 of the cage sleeve, the position corresponding to the upper limit of such sliding motion being shown in Figures 1, 3, and 4, and the lower limit in Figure 2. The flange 45 is provided with a plurality of downwardly facing serrations forming an annular ratch as shown at 52 which is complementary to and adapted to make one-way clutching engagement with the beforementioned lower, upwardly facing annular ratch 47.

The upper and lower cage collars 50 and 51 are resiliently interconnected by suitable drag means which, in the present case, comprise a plurality of outwardly bowing cage springs 53, the intermediate portions of which are adapted to make frictional engagement with the inside wall surface of a well bore or casing as shown at 54. The upper and lower ends of the cage spring 53 may be attached to the collars 50 and 51 by any suitable means, such as by bolts or machine screws, as illustrated at 55 and 56. The cage C comprising the collars 50 and 51 and the interconnecting springs 53 serves, as beforementioned, as a drag means for assisting in the actuation of the device of the invention when it is moved through the well, as hereinafter more fully explained in connection with the operation.

Referring again to the middle section 42 of the cage sleeve 35, a system of interconnected guide slots is formed therein, constituting a circumferentially or circumambiently continuous guide path adapted to cooperate with the beforementioned setting pins 36 to effect control of the relative motion and the locking and unlocking action between the sleeve 35 and the packer mandrel 12. The sleeve section 42 thus has a pair of diametri-

cally positioned longitudinal slots 58 and from an intermediate section of each of these longitudinal slots; an upwardly branching diagonal or helical slot 59 extends. The upper end portion of each longitudinal slot is joined with the upper end portion of each opposite helical slot by an arcuate, circumferentially directed channel 60 formed in the inner surface of the sleeve portion 42. The upper end of each longitudinal slot 58 at the point of juncture with its corresponding arcuate channel 60 is widened to form a rectangular recess or aperture as shown at 62; adapted to receive a latch block 63 in the lower portion thereof. The latch blocks 63 are supported in the apertures 62 with clearance therefrom and limited freedom for lateral deflection, each such support being effected by means of a leaf spring 65. The leaf spring 65 may be attached to the outer surface of the latch block 63, as best shown at 66 in Figure 6, by any suitable means such as, for example, by spot, gas, or arc welding; and the lower end of each such leaf spring 65 may be bolted or screwed at its lower end to the exterior of the sleeve through laterally extending wing projections which bridge the slot as shown at 67. The leaf spring member 65 is preferably bowed outward slightly as best shown at 68 in Figure 6, in order to clear the longitudinal slot for all positions of the latch block 63, and to impart slight longitudinal deflectability to the latch block within the aperture 62 upon application of top loading thereto by means of the setting pin 36, as hereinafter described in connection with the operation. The outer face of each latch block 63 is provided with a pair of laterally extending stop tabs 69 which limit the inward motion of the block into the aperture 62 under the inwardly applied force of the leaf spring support 65.

The inner face of each latch block 63 is formed with a bevelled surface 70 adapted to coact with the outer end of the setting pin when the setting pin is moved upward against it to deflect the latch block outward, to permit upward passage of said setting pin from the longitudinal slot into the upper portion of the aperture 62 to a latched position thereabove at the entrance of the circumferential channel from which it cannot return, by retrograde movement, into the longitudinal part, as best shown in Figures 1, 2, 5, and 6. The upper surfaces of the latch blocks 63 are preferably formed each with a saddle-like depression, as shown at 71 in Figure 5, adapted to serve as a retaining seat for the setting pins 36; and the lower surfaces of the beforementioned arcuate channels 60 interconnecting the upper ends of the slots 58 and 59 are similarly formed with a plurality of spaced, semi-cylindrical depressions 72, as best shown in Figure 9, adapted to receive and serve as retaining seats for the lodging of the setting pins 36 in event they inadvertently or prematurely move into the said arcuate channels 60 as hereinafter more fully described in connection with the operation.

In Figures 5 and 8, a modification of the apparatus of the invention is shown employing one-way latching mechanisms 73 in the diagonal or spiral slots 59 similar to those employed at 63; 65 in the longitudinal slots 58. Each latching mechanism 73 comprises a latch block 74 and a leaf latch spring 75. The leaf spring 75 may be attached to the outer surface of the latch block 74 by any suitable means such as, for example, by spot, gas, or arc welding; and the end of the leaf spring opposite to the latch block may be bolted or screwed to the exterior of the sleeve through

laterally extending wing members which bridge the slot, as shown at 76 in Figures 5 and 8. The inner face of the latch block 74 is formed with a bevelled surface as best shown at 77 in Figure 8; adapted to coact with the outer end of the setting pin when the setting pin is moved downward against it to deflect the latch block outward by flexing the spring 75 to permit, in turn, downward passage of said setting pin from the diagonal slot, past the latch into the intermediate portion of the longitudinal slot 58. Thus, when the setting pin 36 has passed the latch block 74, it is prevented thereby from inadvertently returning; by retrograde movement, into the diagonal slot 59, and when subsequently moved upwardly, is deflected by the diagonal surface 80 of the latch block 74 into the upper portion of the longitudinal slot 58. Retrograde motion of the setting pin 36 and reverse rotation of the sleeve 35 with respect to the mandrel 12 is thus, at all times, substantially prevented. As in the case for the latch block 74 at the top of the longitudinal slot 58, the latch block 74 at the lower end of the diagonal slot 59, is provided with a containing recess which, in this case, is triangular in shape, as best shown at 81 in Figure 5. The diagonal slot 59 joins at its lower end with the triangular recess 81 to form a pair of shoulders on either side thereof as shown at 82 and 83. These shoulders 82 and 83 serve as supports for receiving any upward thrust which may, under some conditions, be imposed upon the latch block 74 by the setting pin 36. The latch block 74, however, normally is supported by the leaf spring 75 with sufficient clearance from the shoulders 82 and 83 to permit free lateral deflection thereof. A stop tab member 85 attached to the outer face of the latch block 74 and extending outward over the marginal portion of the latch block recess 81 serves to limit and determine the inward position of the latch block.

The operation of the apparatus is as follows:

The assembly comprising the packer P and the control cage C are lowered into the casing 10, as shown in Figure 1, with the setting pins 36 seated on the top of the latch blocks 63. During the downward motion of the apparatus through the casing, the frictional drag between the cage springs 53 against the inside surface of the casing 10 will cause the cage assembly to lag or move upward with respect to the cage sleeve 42, carrying the cage collar 51 to its uppermost position against the shoulder 44 and thereby maintaining disengagement of the opposite ratchet clutch elements 47, 52, as shown in Figure 1. The downward force necessary to overcome the sliding friction of the cage springs 53 within the casing 10 will at this time during lowering of the apparatus, be transmitted from the mandrel 12 through the setting pins 36 to the top of the latch blocks 63 and thence through either the leaf springs 65, or, if excessive, through the forced seating contact of the bottom of the latch blocks 63 with the adjacent shoulders formed on either side of the slots 58 in the bottom of the latch block recesses 62, to the cage sleeve.

Advantages of thus providing for transferring the setting pin forces from the latch block to the cage sleeve reside in the lighter, simpler construction which may, therefore, be employed in connection with the resilient support, which, in this case, comprises leaf springs 65.

When the point in the casing is reached, at which it is desired to set the packer, the lowering of the packer P on the run-in string is stopped

and the tubing and the mandrel 12 are then elevated a short distance sufficient to raise the setting pins 36 off the latch blocks 63 and to move them to supporting positions at the tops of the latch block recesses 62, as shown at 36b in Figure 2, thereby lifting the cage sleeve 35 upward relative to the cage spring assembly, thereby bringing the opposite ratchet clutch elements 47, 52, into coupling engagement with one another, as illustrated in Figure 2. As just stated, by this elevating motion the setting pins 36 are raised off of the saddles 70 of the latch blocks 63 and brought up into supporting position against the top of the apertures 62, as shown at 36b in Figure 2 and at this position, the pins 36 sustain the weight of the cage sleeve 35, the slip ring 33, slip reins 32, and the slips 31 coupled thereto.

Immediately following this, the tubing and the mandrel 12 are moved rotationally in a right-hand direction through an angle sufficient to carry the setting pins 36 around from their latched positions above latch blocks 63 shown at 36b in Figure 2, through the arcuate channels 60 to positions adjacent the upper ends of the helical slots 59 as shown in dotted lines at 36c, at which point they are stopped in their rotational movement by abutment with the vertical end walls 78 of the arcuate channels 60 adjoining the top entrances to the said spiral slots. Meanwhile, the cage sleeve 35 is held stationary within the casing by reason of its being coupled through the engaged ratchet clutch 47, 52 to the cage springs which are, in turn, in frictional engagement with the inside surfaces of the surrounding bore hole wall or casing 10. Next, the tubing and the mandrel 12 are lowered a sufficient distance to carry the setting pins 36 downward into the spiral slots 59 from the position shown at 36c in Figure 2 to the position indicated at 36d in Figure 3, and thence on downward into the lower portion of the vertical slot 58 to some such position as that illustrated in dotted lines at 36e in Figures 3 and 4.

Upon commencement of the lowering of the mandrel 12 for movement of the setting pins 36 down into the spiral slots 59, the cage comprising springs 53 and collars 50 and 51 momentarily remain stationary within the bore hole or casing 10 by reason of the supporting frictional engagement of said springs 53 with the inside wall surface thereof, thereby permitting the cage sleeve 35 to move downward relative to the cage sleeve until the cage sleeve shoulder 44 is lowered into contact with the upper end of the cage collar 51, thereby disengaging the ratchet clutch elements 47, 52 as shown in Figures 3 and 4. In this position, the assembly comprising the control cage sleeve 35, the slip ring 33, slip reins 32 and the slips 31 is supported within the well or casing by the frictional engagement of the cage springs with the inside surface of the well wall or casing 10. The disengagement of the clutch 47, 52 frees the cage sleeve 35 for free rotation relative to both the mandrel 12 and the cage springs 53, whereby the continued downward motion of the setting pins 36 through the spiral slots 59 is accomplished without imparting rotation to either the mandrel 12 or to the cage springs 53 within the casing 10, but, instead, the setting pins 36 impart left-hand rotation only to the cage sleeve 35. Thus, while for simplicity of illustration here, the drawings progressively show the setting pins 36 and the mandrel 12 which carries them, as though their downward motion through the spiral slots 59 were accom-

panied by right-hand rotation of the tubing and mandrel, actually only the cage is necessarily imparted the required left-hand rotation.

Continued downward motion of the mandrel next serves to lower the slip expander 25 into the wickered slips 31, thereby causing the slips 31 to move outward along the wedging surfaces of the slip cone 25 into gripping engagement with the inside surface of the casing as shown in Figure 4. Still further downward motion of the tubing and the mandrel next moves the valve head 19 and the valve surface 18 into sealing engagement with the valve seat 17, after which downward weight or pressure applied through the tubing compresses the packer rings 13 between the lower annular surface of the valve seat 16 and the upper surface of the retaining nut 20 and thereby expands them into sealing engagement with the inside surface of the casing as shown in Figure 4 in the manner conventional with packers of this type.

When the packer is set and sealing engagement between the packer rings 13 and the inside surface of the casing is effected, the setting pins will have assumed a position in the lower end portion of the vertical slot 58 in the cage sleeve portion 42, as shown at 36e in Figures 3 and 4.

When the packer is to be released and the packer parts returned to their retracted position, the tubing string and mandrel 12 are first elevated a distance sufficient to bring the setting pins 36 from the position illustrated at 36e in Figures 3 and 4 to the latched position illustrated at 36b in Figure 2. In this position the setting pins will be locked by the action of the latch blocks 63 against return motion down into the longitudinal slots 58. In moving the latch pins from the position shown at 36e in Figures 3 and 4 to the latched position shown at 36b in Figure 1, the valve head 19 is first lifted from the valve seat 17 thereby removing the compressive weight from the packer rings 13, after which the continued elevation of the mandrel 12 will cause the shoulder 28 of the mandrel 12 to be elevated into contact with the lower end of the slip expander 25 and the slip expander thereby raised and withdrawn from the slips 31. The slips 31 and the packer ring are thus released from their gripping engagement with the casing and the whole assembly comprising the packer P, and the control cage C may then be moved up or down the casing to a new setting position or removed from the well, as desired. If it is again desired to set the packer, the tubing and the mandrel 12 are then again rotated a short distance in a right-hand direction from the position shown in Figures 1 and 2, and the process hereinbefore described repeated for again setting the packer in the casing.

In the alternative form of the apparatus in which the added latching mechanisms 73 are employed in the diagonal or helical slots 59, the action of the latch block 74 is such as to permit the setting pins to move downward through the helical slots 59 over the bevelled surfaces 77 of the latch blocks 74 and into the intermediate portion of the longitudinal slots 58, but by their latching action prevents the setting pins 36 from inadvertently returning upon upward movement thereof to the helical or diagonal slots 59.

With either of the alternative versions of the apparatus illustrated in Figures 1 to 4 or that embodying the added latching mechanism, as illustrated in Figure 5, it is to be noted that

the one-way latching mechanism shown in Figures 1, 2, 3, and 4, and at 13 in Figure 5 permits only complete right-hand rotation of the mandrel and the setting pins 36 with respect to the cage sleeve 35. It is, therefore, obvious that the setting pins 36 may be moved from locked position, as shown in Figures 1 and 2, to unlocked position, as shown in Figure 3, and return to the locked position through rotation of the tubing string and the mandrel 12 in the same direction which, in the foregoing example, is a right-hand or clockwise direction as viewed from above. Such rotation, of course, must be accompanied by the longitudinal motion required to follow the slots, as hereinbefore described. Obviously, if desired, the device may be similarly designed to permit only complete left-hand actuating rotation of the mandrel relative to the cage sleeve. This latter arrangement might be desirable under some circumstances where, for example, the pipe string upon which the packer or other tool to be controlled in this manner is lowered, employs left-hand threads in its couplings or other similar parts.

This invention is illustrated in its preferred embodiment, as employing two diametrically positioned setting pins in the mandrel and a double set of longitudinal and branching diagonal slots correspondingly diametrically positioned in the cage sleeve for receiving the two opposite setting pins. However, if desired, only one setting pin in the mandrel and only one set of the combined longitudinal and branching diagonal slots may be employed with the circumferential channel extended to interconnect the adjacent ends of these slots.

This invention is also illustrated in its preferred embodiment with the inner sleeve or mandrel member carrying the setting pins 36 and the outer concentric cage sleeve carrying the slot in which the setting pins are adapted to slide, but, obviously, a reversal of the relative positions of the setting pin and slotted sleeve may be effected, within the scope of the invention and without altering its principle of operation, thereby placing the setting pins 36 in the outer sleeve member and the slots in the inner concentric sleeve.

The terms guide slot and pin have been employed herein in connection with the illustration of the preferred embodiment and in the claims, but it is not intended to thus limit the invention, for any equivalent cam structure may be substituted for the slot and any suitable equivalent guide member or follower means may be substituted for the pins without departing from the invention.

As hereinbefore mentioned, the apparatus of this invention is shown by way of illustration as applied to the control of a conventional type of casing packer, but it is intended that the control device of this invention shall be similarly applicable for control of any device or tool adapted to be lowered into a bore hole and requiring operational movements and control at such remote location. For example, the control device of this invention may, if desired, be employed for operation of a valve or flow device or for the firing of a gun perforator located within the depths of a producing well, by similar manipulation of the tubing.

The control device of this invention may also be employed in an inverted position, relative to that illustrated in the drawings, for use in connection with packer hold-down apparatus and the like tools without material deviation from

the principle of operation or the essential features of the invention.

It is to be understood that the foregoing is illustrative only, and that the invention is not limited thereby, but may include various modifications and changes which may be made by those skilled in the art without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A well apparatus control device comprising: a pair of concentric, cylindrical members rotationally and longitudinally slidable with respect to one another; a continuous guide slot extending around one of said members; a pin fixed in the other of said members and extending slidably into said guide slot, said slot having a longitudinal part, a separate diagonal part branching from an intermediate portion of said longitudinal part, and a circumferential part extending from said longitudinal part and comprising a part circumambiently interconnecting the adjacent ends of said longitudinal and diagonal parts; a one-way latching means in the end of said longitudinal part adjacent the juncture thereof with said circumferential part, adapted to lock said pin at the end of said longitudinal part in the entrance of said circumferential part to prevent said pin from returning therefrom into said longitudinal part other than through said circumferential and diagonal parts but permitting said pin to move laterally therefrom into the said circumferential and diagonal parts.

2. A well apparatus control device comprising: a pair of concentric, cylindrical members rotationally and longitudinally slidable with respect to one another; a continuous guide slot extending around one of said members; a pin fixed in the other of said members and extending slidably into the said guide slot, said slot having a longitudinal part, a diagonal part branching from an intermediate portion of said longitudinal part, and a circumferential part extending from said longitudinal part and forming a circumambient interconnection between the adjacent ends of said longitudinal and diagonal parts; a one-way latching means in said diagonal part adapted to allow passage of said pin throughout said diagonal part in one direction from the intermediate portion of said circumferential part to said longitudinal part but preventing retrograde passage of said pin from said longitudinal part through said diagonal part to said circumferential part.

3. A well apparatus control device comprising: a pair of concentric, cylindrical members rotationally and longitudinally slidable with respect to one another; a continuous guide slot extending around one of said members; a pin fixed in the other of said members and extending slidably into said guide slot, said slot having a longitudinal part, a diagonal part branching from an intermediate portion of said longitudinal part, and a circumferential part forming at least a portion of a part circumambiently interconnecting the adjacent end portions of said longitudinal and diagonal parts; a one-way latching means in the end portion of said longitudinal part adjacent the juncture thereof with said circumferential part adapted to lock said pin at the entrance of said circumferential part at the end portion of said longitudinal part to prevent it from returning into said longitudinal part other than through said circumferential and diagonal parts but permitting said pin to move laterally from said longitudinal part into said circumferential

part, and a one-way latching means in said diagonal part adapted to allow passage of said pin through said diagonal part in one direction from said circumferential part to said longitudinal part but preventing retrograde passage of said pin from said longitudinal part through said diagonal part to said circumferential part.

4. In a well apparatus control device, apparatus comprising: a pair of concentric sleeve members rotationally and longitudinally movable with respect to one another; a continuous guide slot extending continuously around one of said members; a pin fixed in the other of said members and extending slidably into the said guide slot, said slot having a longitudinal part, a diagonal part branching from a portion of said longitudinal part and a circumferential part below the upper end thereof and extending between and circumambiently interconnecting the adjacent ends of said longitudinal and diagonal parts, the rotational and longitudinal movement of said sleeve members relative to one another being thereby limited to that permitted by movement of said pin along said slot; a first collar rotationally and longitudinally slidably supported coaxially on an upper portion of the outermost one of said sleeve members; a second collar rotationally and longitudinally slidably supported coaxially on the lower portion of the outermost one of said sleeve members; a plurality of outwardly bowed, resilient members interconnecting said collars, said outwardly bowed members being adapted to make dragging engagement with the inside surface of a surrounding wall; a first clutch element on one of said collars; and a second clutch element fixed to the outermost one of said sleeve members, said first and second clutch elements being movable into coupling engagement with one another to resist relative rotation between said outermost one of said sleeve members and said one of said collars when said outermost sleeve member is moved longitudinally relative to said collars in a direction opposite to that in which said longitudinal part of said guide slot extends away from said circumferential part thereof, and said clutch elements being movable out of engagement with one another to permit relative rotation therebetween when said outermost sleeve member is moved longitudinally in the opposite direction with respect to said collars.

5. Apparatus according to claim 4 and in which the said first and second clutch elements are provided with complementary ratchet-shaped teeth adapted, when in engagement, to effect positive, non-rotational coupling with one another to hold said outer sleeve member against rotation relative to said one of said collars in the direction in which said circumferential part of said slot extends around said one of said sleeve members from the end of the longitudinal part toward the adjacent end of the diagonal part.

6. In a well apparatus control device, apparatus comprising: a pair of coaxial members coaxially rotatable and longitudinally slidable with respect to one another; a guide slot in one of said members; a pin fixed in the other of said members and extending slidably into the said guide slot, said slot having a longitudinal part and a circumferential part, the rotational and longitudinal movement of said members relative to one another being thereby limited to that permitted by movement of said pin along said slot; drag means operatively connected to said members and coaxially rotatable and longitudinally movable with respect thereto, said drag means being adapted

to frictionally engage the inside surface of a surrounding wall; clutch means carried by said device and operative upon relative longitudinal sliding movement of said one of said members relative to said drag means in a direction opposite to that in which said longitudinal part of said guide slot extends away from said circumferential part thereof, to couple said drag means to said one of said members to resist relative rotation between said drag means and said one of said members, and disengageable upon relative longitudinal sliding movement in the opposite direction of said one of said members relative to said drag means to release said clutch means to permit relative rotation between said drag means and said one of said members; and means to impart longitudinal and rotational movement to said other of said pair of members.

7. In a well apparatus control device, apparatus comprising: inner and outer coaxial cylindrical members rotationally and longitudinally slidable with respect to one another, the inner one of said members being adapted to be connected to a pipe string; a continuous guide slot extending around one of said members, said slot having a longitudinal part, a diagonal part branching from an intermediate portion of said longitudinal part, and a circumferential part extending between and circumambiently interconnecting the adjacent ends of said longitudinal and diagonal parts; a guide member fixed in the other of said cylindrical members and extending slidably into said guide slot, the rotational and longitudinal movement of said coaxial cylindrical members relative to one another being thereby limited to that permitted by movement of said guide member along said guide slot; drag means carried by one of said cylindrical members and coaxially rotatable and longitudinally movable with respect thereto, said drag means being adapted to frictionally engage the inside surface of a surrounding wall; and clutch means on said device engageable to make coupling between said drag means and the outer one of said cylindrical members to resist relative rotation between said drag means and said outer one of said cylindrical members when said outer one of said cylindrical members is moved longitudinally relative to said drag means in a direction opposite to that in which said longitudinal part of the guide slot extends away from said circumferential part, and to disengage said coupling when said outer one of said cylindrical members is moved relative to said drag means in the opposite direction.

8. Apparatus in accordance with claim 7, and in which the said clutch means is a one-way device adapted to hold said outer cylindrical member against rotation relative to said drag means in the direction in which said circumferential part of the guide slot extends around said one of said cylindrical members from the end of the longitudinal part toward the adjacent end of the diagonal part of said slot, and to permit rotation of said outer cylindrical member relative to said drag means in the opposite direction.

9. Apparatus in accordance with claim 8, and a one-way latching means in said diagonal part of said guide slot, adapted to allow passage of said guide member throughout said diagonal part in one direction directly from said circumferential part to the intermediate portion of said longitudinal part but preventing retrograde passage of said guide member from said longitudinal part directly through said diagonal part to said circumferential part.

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10. Apparatus in accordance with claim 7, and a one-way latching means in the end of said longitudinal part of said guide slot, adjacent the juncture thereof with said circumferential part, adapted to lock said guide member at the end of said longitudinal part in the entrance of said circumferential part, to prevent said guide member from returning therefrom into said longitudinal part other than indirectly through said circumferential and diagonal parts respectively, but permitting said guide member to move laterally directly therefrom into the said circumferential part.

11. In a well apparatus control device, apparatus comprising: inner and outer coaxial cylindrical members rotationally and longitudinally slidable with respect to one another, the inner one of said members being adapted to be connected to a pipe string; a continuous guide slot extending around the outer one of said cylindrical members, said slot having a longitudinal part, a diagonal part branching upwardly from a portion of said longitudinal part below the upper end thereof, and a circumferential part extending between and circumambiently interconnecting the upper adjacent ends of said longitudinal and diagonal parts; a guide member fixed in the inner one of said cylindrical members and extending slidably into said guide slot, the rotational and longitudinal movement of said coaxial cylindrical members relative to one another being thereby limited to that permitted by movement of said guide member along said guide slot; drag means carried by one of said cylindrical members and coaxially rotatable and longitudinally movable with respect thereto, said drag means being adapted to frictionally engage the inside surface of a surrounding wall; and clutch means on said device engageable to make coupling between said drag means and said outer one of said cylindrical members to resist relative rotation between said drag means and said outer one of said cylindrical members when said outer one of said cylindrical members is moved upward relative to said drag means and to disengage said coupling when said outer cylindrical member is moved downward relative to said drag means.

12. Apparatus in accordance with claim 11 and

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in which the said clutch means is a one-way device adapted to hold said outer cylindrical member against rotation relative to said drag means in the direction in which said circumferential part of the guide slot extends around said outer one of said cylindrical members from the upper end of the longitudinal part toward the adjacent upper end of the diagonal part of said slot, and to permit rotation of said outer cylindrical member relative to said drag means in the opposite direction.

13. Apparatus in accordance with claim 11, and a one-way latching means in the end of said longitudinal part of said guide slot, adjacent the juncture thereof with said circumferential part, adapted to lock said guide member at the end of said longitudinal part in the entrance of said circumferential part, to prevent said guide member from returning therefrom into said longitudinal part other than indirectly through said circumferential and diagonal parts respectively, but permitting said guide member to move laterally directly therefrom into the said circumferential part.

14. Apparatus in accordance with claim 11, and a one-way latching means in said diagonal part of said guide slot, adapted to allow passage of said guide member throughout said diagonal part in one direction directly from said circumferential part to the intermediate portion of said longitudinal part but preventing retrograde passage of said guide member from said longitudinal part directly through said diagonal part to said circumferential part.

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