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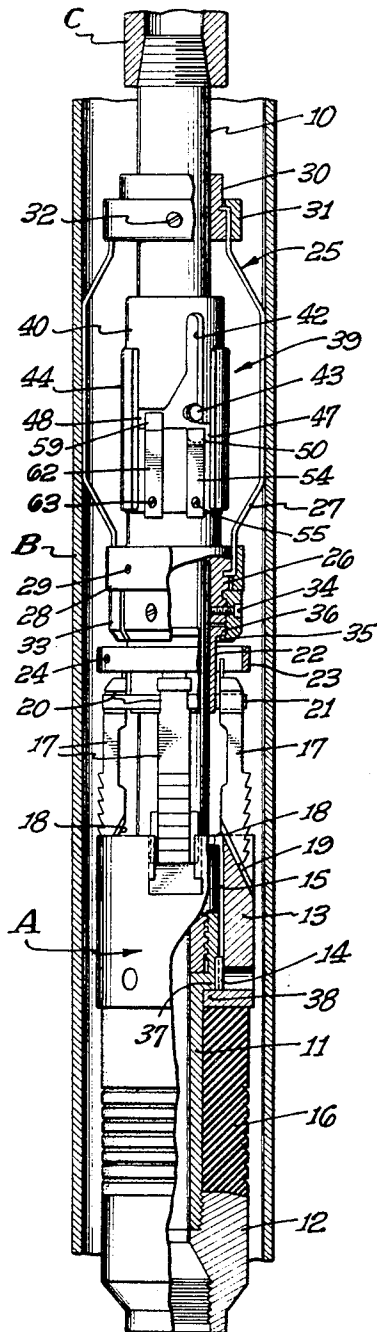
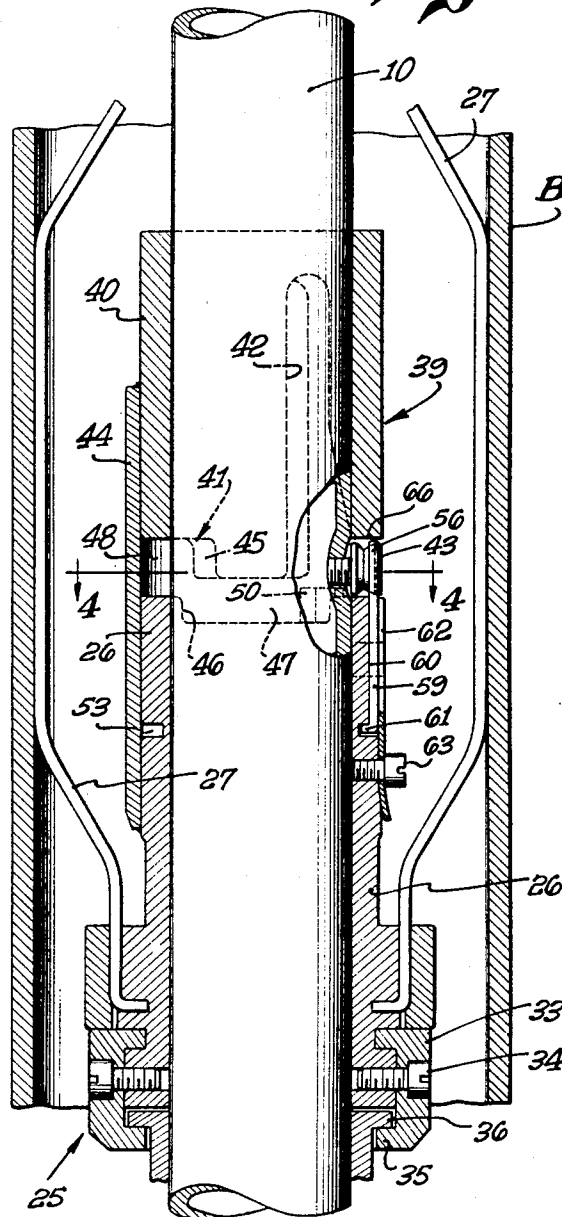
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SAFETY LOCK FOR WELL TOOLS

Filed April 15, 1944

2 Sheets-Sheet 1

Fig. 1.*Fig. 2.*

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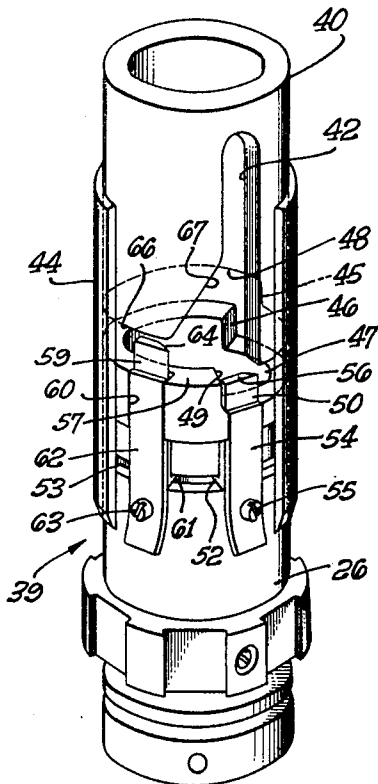
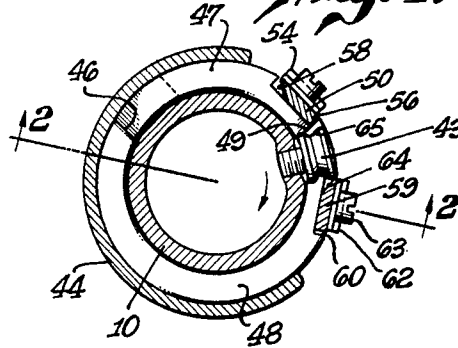
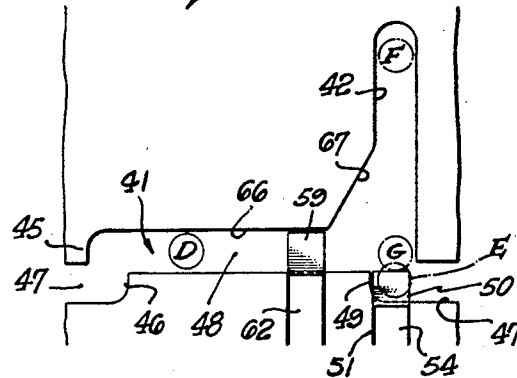
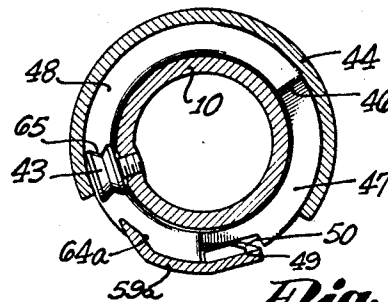
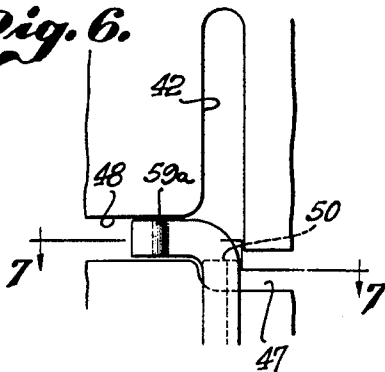
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2 Sheets-Sheet 2

Fig. 3.*Fig. 4.**Fig. 5.**Fig. 6.**Fig. 7.*

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SAFETY LOCK FOR WELL TOOLS

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Application April 15, 1944, Serial No. 531,245

11 Claims. (Cl. 166—12)

1

This invention relates to well tools, and more particularly to the locking portion of such tools which are designed for sub-surface operations in well bores.

Locking devices are used in connection with many tools designed for operations in well bores. One of the most common of such devices is a J or L pin and slot arrangement employed with packers, liner hangers, tubing anchors, well washers, etc. Such J, L, and similar types of locks can function to maintain certain well tool parts in a definite relative position, or they can be manipulated to release such parts and permit their performance of the particular action or operation in the well bore, such as to set a packer or liner therein, control a valve, etc.

In locking and unlocking the J or L devices, it is necessary to turn the string of tubing to which the tool is attached either to the right or left. Tubing or drill pipe strings are made up of sections connected together by right hand threaded joints, although occasionally a set of left hand threads is used. Regardless of the type of threaded connection availed of, the turning of the tubing string in one direction to manipulate the J or L lock will tend to tighten the threaded joints, but turning of such string in the other direction tends to unscrew or disconnect it at one or more of the joints. This is especially true when the tool is operated in a crooked hole or under conditions in the well bore which can freeze the tool therein, making it necessary to impose a comparatively large torque on the tubular string in order to operate the locking device.

It is an object of the present invention to overcome the aforementioned difficulties by providing an improved well tool whose parts can be locked or relocked without the necessity for turning the tubular string in a direction in which its joints might become loosened or unscrewed from one another, and in which the parts cannot become inadvertently unlocked.

The invention has other objects that will become apparent from a consideration of the embodiments shown in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, but it is to be understood that such detailed description is not to be taken in a limited sense since the scope of the invention is best defined by the claims appended hereto.

Referring to the drawings:

Figure 1 is a longitudinal view, partly in section

2

and partly in elevation, of a well tool embodying the present invention;

Figure 2 is a longitudinal section on an enlarged scale of part of the well tool described in Figure 1, taken along the line 2—2 in Figure 4;

Figure 3 is a perspective of the slot and latch portion of the well tool;

Figure 4 is a cross section taken along the line 4—4 in Figure 2;

Figure 5 is a diagrammatic view illustrating several relative positions that the lock parts of the well tool can occupy;

Figure 6 is a fragmentary elevation of part of a modified form of latch device; and

Figure 7 is a cross section taken along the line 7—7 in Figure 6.

The invention is exemplified in the drawings as forming part of a well packer of the retrievable type. It is to be understood, however, that the invention is also applicable to other well tools, as the following detailed description of the apparatus shown in the drawings will bring out.

The packer illustrated in the drawings is specifically described and particularly claimed in the application of Reuben C. Baker for "Releasable well packers," Serial No. 419,061, filed November 14, 1941, now patent No. 2,368,400, granted January 30, 1945. This packer A is adapted to be run in a well bore or casing B on the end of a tubular string C threadedly or otherwise attached to the upper end of the tubular mandrel 10 of the packer. The lower end of this mandrel is threaded into the upper end of a tubular packer body 11, to the lower end of which is secured a packing actuator 12 in the form of a guide.

A tapered expander 13 mounted on the body is preferably prevented from turning with respect thereto by a key 14 secured to the exterior of the body 11 and received within a keyway 15 in the expander, so as to permit relative longitudinal movement between the body and expander, while preventing rotation therebetween. When the tubular string C, mandrel 10 and body 11 are elevated, the packing actuator 12 is moved towards the expander 13 to compress an intervening packing sleeve 16 surrounding the body and force it outwardly to effect an annular seal between the body 11 and casing B. Such actuation of the packing sleeve 16 only occurs when the tapered expander 13 is prevented from moving upwardly, which results from anchoring engagement by a plurality of slips 17, cooperating with the tapered expander, with the wall of the casing. The slips 17 have tapered surfaces 18 cooperating with companion tapered surfaces 19 on the ex-

3

pander, the inclination of such surfaces being such as to move the slips 17 outwardly toward the casing upon elevation of the expander 13. Conversely, lowering of the expander with respect to the slips permits the latter to release from anchoring engagement with the wall of the casing and move inwardly to retracted position.

It is, therefore, apparent that elevation of the tubular string C, mandrel 10 and packer body 11 can effect anchoring of the tool through engagement of the slips 17 with the casing under the influence of the tapered expander 13, and they can also effect compression of the packing sleeve 16 between the expander 13 and guide 12 to produce its radial outward expansion into sealing engagement with the wall of the casing.

The slips 17 are held together for joint movement along the tapered expander 13 to and from engagement with the casing by providing recesses 20 in their side faces, which receive outwardly extending fingers 21 for guiding the slips to and from the casing and for preventing their longitudinal movement except in unison by engaging the ends of the recesses 20. These fingers 21 are integral with a sleeve 22 slidable on the mandrel 10, which has a stop ring 23 secured thereto by screws 24 or the like for the purpose of limiting the extent of outward movement of the slips.

The sleeve 22, and the slips 17 assembled thereon, are coupled to a drag and lock device 25, comprising a lower collar 26 slidable on the mandrel 10, which receives the lower ends of a plurality of circumferentially spaced outwardly bowed springs 27 held thereagainst in assembled relation by a ring 28 fastened to the collar by a plurality of screws 29. These springs are disposed around the mandrel with their upper ends secured to an upper drag collar 30 by an upper ring 31 suitably fastened thereto, as by screws 32.

The drag and lock device 25 is coupled to the slip assembly by means of a sectional tie or coupling ring 33 secured to the lower collar 26 by screws 34, and having a lower interned flange 35 receiving and fitting under an external flange 36 at the upper end of the slip sleeve 22. Rotation of the tubular string C, mandrel 10 and drag device 25 is permitted without corresponding rotation of the slip assembly sleeve 22 and slips 17, due to the swivel type of action provided by the lower end of the coupling ring 33 and sleeve flange 36.

It is to be noted that the drag device 25 engages the casing wall and thereby tends to resist longitudinal movement of the slips 17 coupled thereto through the well casing. Upon reaching the desired setting point in the casing, if the tubular mandrel 10 is permitted to move upwardly with respect to the drag device, such elevation would also elevate the body 11 of the packer, and through the guide 12 and packing sleeve 16 elevate the expander 13 within the slips 17, since the latter are prevented from moving upwardly by the drag device, to force the slips radially outward into anchoring engagement with the casing wall. A continuation of such upward movement causes compression of the packing sleeve 16 into sealing engagement with the casing B and body 11, in the manner hereinbefore described. Conversely, lowering of the tubular mandrel 10 with respect to the drag device 25 permits retraction of the packing sleeve 16 from the casing wall and produces corresponding downward movement of the tapered expander 13,

4

through engagement of the body shoulder 37 with the expander flange 38, so that the slips 17 are movable inwardly to retracted position, since they are prevented from moving longitudinally by the drag device.

It should be noted that upward movement of the tubular mandrel 10 and body 11 can effect anchoring of the packer in packed off condition within the well casing, and that lowering of these members can effect release of the packer. It is, therefore, essential that some means be provided for preventing relative movement between the slips 17 and the tapered expander 13 in order to allow the tubular mandrel 10 to be elevated without anchoring the tool in the well casing, as when the entire tool is to be raised within the well casing.

A device for locking slips with respect to an expander, or for that matter, for preventing relative movement until desired between cooperative parts of sub-surface well tools generally, is a J or L type of lock. Such lock can include a pin operable within a longitudinal slot and an intersecting horizontal slot. When the pin is positioned in the horizontal slot the tool members are locked, and when the pin is positioned in the longitudinal slot, the tool members are unlocked and the tool may be manipulated in the desired fashion, depending upon its design and the purpose for which it is to be used. However, movement of the pin within the horizontal slot to and from the longitudinal slot (or to and from locking and unlocking positions) is performed through turning or rotation of the tubular string to which the tool is attached in a clockwise or counterclockwise direction. Assuming that the tubular string is made up of right hand thread connected joints, its rotation in a clockwise direction would tend to tighten the joints, while rotation in the opposite or counterclockwise direction would tend to loosen the joints. That is one of the difficulties with this type of pin and slot arrangement. It requires counterclockwise or left hand turning of the tubular string for its effective and complete operation.

The present invention overcomes this disadvantage and difficulty through its ability to effect locking and unlocking of the device and the slips 17 through turning of the tubular string in one direction only. In the case of a tubular string in which the threaded joints are right hand, such turning takes place in a clockwise direction. It is apparent, however, that the locked device could be so designed as to operate upon turning in a counter-clockwise direction only, where a left hand threaded tubular connection is employed.

As shown in the drawings, the locking device 39 is incorporated in the lower portion of the drag device 25. A sleeve 40 extends upwardly from the lower collar 26 and is spaced therefrom to form a circumferential slot or groove 41 completely around the mandrel 10 disposed substantially entirely in a horizontal position. This sleeve has a longitudinal slot 42 extending upwardly from the circumferential slot to permit upward sliding of the mandrel 10 therewithin whenever a locking pin 43, secured to the mandrel, is positioned in the longitudinal slot portion. The sleeve 40 is maintained in proper spaced relation with respect to the lower collar 26 and is movable therewith by suitable means, as by bridging the circumferential slot 41 by a partial sleeve 44 whose upper and lower ends are

2,429,910

5

suitably secured to the sleeve 40 and lower collar 26, respectively, as by welding.

The mandrel lock pin 43 is movable in the longitudinal slot portion 42 and also in the circumferential slot portion 41 of the locking device. It is apparent that when the mandrel 10 has been lowered with respect to the drag device 25 in order to position the pin 43 in the circumferential slot 41 the tool A is in locked position and the slips 17 and packing sleeve 16 will be retained in retracted position, allowing the tool to be moved longitudinally in either direction through the casing B. However, turning of the tubular string C and mandrel 10 to align the pin 43 with the longitudinal slot 42 allows the tubular string C to be moved upwardly to set the slips 17 and packing 16 against the casing wall.

It is to be noted that the generally horizontal circumferential slot 41 does not all lie in a single transverse plane. The lower end of the sleeve 40 is formed with a downwardly extending step 45 cooperating with a companion downwardly extending recess 46 in the upper end of the lower collar 26 to form a lower portion 47 of the slot, depressed below its upper portion 48. However, these slot portions are communicable with each other to permit passage of the pin 43 on the mandrel 10 from one slot portion to the other. The difference in elevation between these slot portions is insufficient to cause material movement of the packer parts by the mandrel 10 when the pin 43 is shifted between them, so that the slips 17 and packing 16 are moved only slightly and will remain in retracted positions.

Both the upper and lower slot portions 48, 47 merge into the longitudinal slot 42, but at different elevations. The lower slot portion 47 lies in a transverse plane which intersects the longitudinal slot below the position at which the upper slot portion 48 intersects the longitudinal slot, thereby forming a stop shoulder 49 for engagement by the pin 43 when it is rotated clockwise within the lower slot 47 toward the longitudinal slot 42. When this position is reached the operator can be notified of that fact by the feel of the tubing string C, allowing him to elevate the tubing string C and mandrel 10, as permitted by movement of the pin 43 within the longitudinal slot, to cause setting of the packer parts, as described above.

When the tool is to be released and the packer parts returned to retracted position, the tubing string C and mandrel 10 are lowered with respect to the drag device 25, as permitted by the lowering of the lock pin 43 within the longitudinal slot 42, until the pin is at the intersection between the longitudinal slot 42 and the upper slot portion 48. In order to locate the pin positively at this point of intersection, a stop or locating latch 50 is provided in the lower portion of the longitudinal slot 42.

The upper portion of the lower drag collar 26 is formed with a longitudinal groove 51 in its outer surface in which is positioned the locating latch 50 having an inwardly directed lug 52 at its lower end fitting loosely within a circumferential groove 53 in the collar. A leaf spring 54 is secured at its lower end to the lower drag collar by suitable means, such as a screw 55, and extends upwardly over the latch 50 to urge it inwardly across the lower slot portion 47 and into the lower end of the longitudinal slot 42 adjacent the stop shoulder 49. The upper end 56 of the latch terminates in the same transverse plane as the lower surface 57 on the upper drag collar

6

defining the upper slot portion 48, in effect forming a continuation of this slot and also a shiftable lower terminus for the longitudinal slot 42. The inner side surface 58 at the upper portion of the latch is beveled to form a cam which can be acted upon by the pin when it is turned from the lower slot portion 47 into the longitudinal slot 42. The pin engages the beveled surface 58 and pivots the latch outwardly on its fulcrum lug 52 against the action of the leaf spring 54, until the pin engages the stop shoulder 49 at the lower end of the longitudinal slot. Elevation of the pin 43 within the slot 42 and above the locating latch 50 allows the spring 54 to shift the latch back to its inward position across the longitudinal slot, in order that lowering of the pin within the longitudinal slot can thereafter cause its engagement with the upper end 56 of the locating latch, to prevent its reentry into the lower slot portion 47.

After lowering the pin 43 within the longitudinal slot 42 into engagement with the locating latch 50, the tubing string C and mandrel 10 are turned in a clockwise direction to reposition the pin in the upper horizontal slot 48 of the locking device. It is desired, however, that the pin be incapable of moving from this upper horizontal slot back into the longitudinal slot 42 upon counterclockwise movement of the tubing string and mandrel. To achieve this purpose a second latch 59 is positioned in a longitudinal groove 60 formed in the outer surface of the lower drag collar 26. This latch can be formed in exactly the same manner as the other latch, being provided with an inwardly directed lug 61 fitting loosely within the circumferential groove 53 and pivoting about the lug in moving its upper end into and out of the upper slot portion 48. The upper end of the latch 59 is urged into the upper slot portion 48 by a leaf spring 62 extending over and bearing against its exterior, the lower end of this spring being secured to the lower drag collar by a screw 63.

The side of the latch facing the longitudinal slot is provided with an inner beveled edge or cam surface 64 engageable by the lock pin to shift the latch 59 out of its path of movement in moving in a clockwise direction within the slot 48. After having moved beyond the latch, the leaf spring 62 repositions the latch across the slot 48, which prevents the pin from moving in a counterclockwise direction from the upper slot portion 48 back into the longitudinal slot 42. This action of the latch is assisted by the pin 43 itself, by providing its head with an undercut and inwardly tapering portion 65, which engages the side of the latch to urge it inwardly and thus hold it across the upper horizontal slot 48.

In the operation of the device, the tool is lowered in the well bore with the slips 17 and packing 16 in retracted positions and with the pin 43 located within the upper portion 48 of the horizontal slot 41, as represented by letter D in Figure 5. When the desired setting point is reached the tubing string C and mandrel 10 are rotated in a clockwise direction until the pin 43 engages the step 45, whereupon the tubing string and mandrel are lowered a short distance to position the pin in the lower horizontal slot portion 47. Continued clockwise movement of the mandrel causes the pin to shift the locating latch 50 out of its path of travel and position itself against the stop shoulder 49 at the lower end of the longitudinal slot 42 (position E in Figure 5). The tubing string C and mandrel can then be elevated to po-

7

sition the pin above the locating latch 50, which will then be snapped back to its initial inward position by the latch spring 54. The tubing string and connected mandrel 10 may then be elevated, with the pin 43 moving within the longitudinal slot, to set the slips and packing against the casing, in the manner above described (position F in Figure 5).

When it is desired to release the slips and packing and move them back to retracted position, the tubing string and mandrel are lowered. The extent of lowering is determined by engagement of the pin 43 with the upper end 56 of the locating latch 50. The tool can be set and released as many times as desired at a given location merely by moving the tubing string and mandrel longitudinally within the sleeve 40. When it is desired to release the tool and relock its parts in retracted position, the tubing string and mandrel are lowered until the pin 43 engages the upper end 56 of the locating latch (position G in Figure 5), which advises the operator that the pin is in alignment with the upper horizontal slot portion 48, and which prevents the pin from moving back into the lower horizontal slot portion 47. The mandrel is then rotated in a clockwise direction to rotate the pin within the upper horizontal slot portion 48 until it engages the beveled surface 64 of the locking latch 58, shifting it out of the slot 48 and moving to the other side of the latch 59 (position D in Figure 5). The latch is then snapped back into the upper slot 48 by its leaf spring 62 to prevent return movement of the lock pin 43, in a counterclockwise direction, into the longitudinal slot. The tool can now be elevated in the well bore with the parts in locked position or removed entirely therefrom.

It is to be noted that when the locking pin 43 is in the upper horizontal slot 48 (position D) its rotational movements are limited in both directions through its engagement with the latch 59 upon counterclockwise movement, and with the downwardly directed step 45 upon clockwise movement. As a result, the lock pin cannot shift inadvertently into the lower slot 47 upon elevating the tool within the well bore, since such elevation urges the pin against the upper surface 66 of the upper slot 48. The tool may be elevated as quickly as possible within the well casing without fear of the pin 43 moving into alignment with the longitudinal slot 42, which would cause undesired setting of the well packer.

If desired, a latch opening 67 may be formed in the sleeve 40 to facilitate movement of the lock pin 43 from the longitudinal slot 42 into the horizontal slot 48, and the latch 59 may be positioned a substantial distance from the locating latch 50 so as to require a partial revolution of the tubing string and mandrel before the pin 43 can be disposed in its normal locked position within the upper horizontal slot 48 (position D). This permits the pin to be moved within the longitudinal slot 42 in setting and releasing the packer without fear that slight rotary movements imparted to the tubing string C might shift the pin beyond the latch 59 to its locked position within the upper horizontal slot 48.

A modification of the device is illustrated in Figures 6 and 7, in which a single latch is provided to perform the functions of the two latches 50, 59 in the other embodiment of the invention. The locating latch 50 has a locking latch 59a secured to its outer surface and extending to the left thereof into the upper horizontal slot 48.

8

The locking latch 59a is provided with a beveled edge 64a, as in the other modification, for engagement by the pin 43 to shift the latch out of its path of travel against the action of the leaf spring 54. Any tendency of the pin to move in a counterclockwise direction from the upper horizontal slot 48 back into the longitudinal slot 42 is forestalled by engagement of the tapered surface 65 on the pin with the latch 59a, urging the latter inwardly to maintain it in its locked position.

It is, therefore, apparent that a safety locking device has been provided for well tools which can be moved between locked and unlocked position through rotation of the tubing string connected to the tool in a single direction, which is the direction that tends to tighten the joints of the tubular string. It is also apparent that the arrangement of the upper and lower portions 48, 47 of the slots are such that the pin 43 cannot be moved inadvertently into the longitudinal slot 42 to set the tool, upon elevation of the same within the well bore. The latch 50 at the lower end of the longitudinal slot positively locates the pin in alignment with the upper horizontal slot 48 upon lowering of the pin within the longitudinal slot, and the locking latch 59 or 59a prevents retrograde movement of the pin from the upper slot 48 into the longitudinal slot 42.

We claim:

1. A well tool adapted for operation in a well bore, including a first member connectable to a running-in string for moving said tool within said well bore, a second member in which said first member is movable, one of said members being provided with a longitudinal slot and a circumferential slot disposed substantially entirely in a horizontal position and comprising upper and lower portions communicating with said longitudinal slot at different elevations, the other of said members being provided with a pin movable along said circumferential and longitudinal slots, and a one-way latch device in said upper slot portion shiftable by said pin from its path of movement for permitting passage of said pin from said longitudinal slot into said upper slot portion but which prevents retrograde movement of said pin from said upper slot portion into said longitudinal slot.

2. A well tool adapted for operation in a well bore, including a first member connectable to a running-in string for moving said tool within said well bore, a second member in which said first member is movable, one of said members being provided with a longitudinal slot and a circumferential slot disposed substantially entirely in a horizontal position and having a first portion intersecting said longitudinal slot intermediate its length and a second portion intersecting said longitudinal slot at one of its ends, the other of said members being provided with a pin movable along said circumferential and longitudinal slots, and a one-way latch device in said first slot portion shiftable by said pin from its path of movement for permitting passage of said pin from said longitudinal slot into said first slot portion but which prevents retrograde movement of said pin therefrom.

3. A well tool adapted for operation in a well bore, including a first member connectable to a running-in string for moving said tool within said well bore, a second member in which said first member is movable, one of said members being provided with a longitudinal slot and a circumferential slot disposed substantially en-

2,429,910

9

tirely in a horizontal position and comprising upper and lower portions communicating with said longitudinal slot at different elevations, the other of said members being provided with a pin movable along said circumferential and longitudinal slots, and latch means in said slot portions shiftable by said pin from its path of movement for permitting passage of said pin in one direction only from said lower slot portion into said longitudinal slot and from said longitudinal slot into said upper slot portion.

4. A well tool adapted for operation in a well bore, including a first member connectable to a running-in string for moving said tool within said well bore, a second member in which said first member is movable, one of said members being provided with a longitudinal slot and a circumferential slot disposed substantially entirely in a horizontal position and having a first portion intersecting said longitudinal slot intermediate its length and a second portion intersecting said longitudinal slot at one of its ends, the other of said members being provided with a pin movable along said circumferential and longitudinal slots, and latch means in said first and second slot portions shiftable by said pin from its path of movement for permitting passage of said pin in one direction only from said second slot portion into said longitudinal slot and from said longitudinal slot into said first slot portion.

5. A well tool having relatively movable parts, means for controlling longitudinal movement of said parts with respect to one another, including a first member connectable to a running-in string and attached to one of said parts, a second member attached to another of said parts, one of said members being movable within the other of said members, one of said members being provided with a longitudinal slot and a circumferential slot disposed substantially entirely in a horizontal position and having a first portion intersecting said longitudinal slot intermediate its length and a second portion intersecting said longitudinal slot at one of its ends, the other of said members having a pin movable along said longitudinal and circumferential slots, and means in said first slot portion for preventing passage of said pin from said circumferential slot into said longitudinal slot upon relative rotary movement between said members.

6. A well tool having relatively movable parts, means for controlling longitudinal movement of said parts with respect to one another, including a first member connectable to a running-in string and attached to one of said parts, a second member attached to another of said parts, one of said members being movable within the other of said members, one of said members being provided with a longitudinal slot and a circumferential slot disposed substantially entirely in a horizontal position and having upper and lower portions communicating with said longitudinal slot at different elevations, the other of said members having a pin movable along said longitudinal and circumferential slots, and means in said upper slot portion for preventing passage of said pin from said upper slot portion into said longitudinal slot upon upward movement of said tool within said well bore.

7. A well tool having relatively movable parts, means for controlling longitudinal movement of said parts with respect to one another, including a first member connectable to a running-in string and attached to one of said parts, a second mem-

10

ber attached to another of said parts, one of said members being movable within the other of said members, one of said members being provided with a longitudinal slot and a generally horizontal slot having a first portion intersecting said longitudinal slot intermediate its length and a second portion intersecting said longitudinal slot at one of its ends, the other of said members having a pin movable along said longitudinal and horizontal slots and latch means at the intersection of said second portion and longitudinal slot permitting passage of said pin from said second slot portion into said longitudinal slot upon relative rotary movement in one direction between said members, said latch means engaging said pin to prevent its movement from said longitudinal slot into said second slot portion upon relative movement in another direction between said members.

8. A well tool having relatively movable parts, means for controlling longitudinal movement of said parts with respect to one another, including a first member connectable to a running-in string and attached to one of said parts, a second member attached to another of said parts, one of said members being movable within the other of said members, one of said members being provided with a longitudinal slot and a circumferential slot disposed substantially entirely in a horizontal position and having upper and lower portions communicating with said longitudinal slot at different elevations, the other of said members having a pin movable along said longitudinal and circumferential slots, and means extending into the lower end of said longitudinal slot and terminating at the elevation of the said upper slot portion for permitting passage of said pin from said lower slot portion into said longitudinal slot upon relative rotary movement in one direction between said members, said extending means engaging said pin to lock it in alignment with said upper slot portion upon lowering of one of said members with respect to said other member.

9. A well tool having a body and normally retracted means on said body adapted for outward movement into engagement with a well casing, means for locking said means in retracted position with respect to said body comprising a first member operatively connected to said body and connectable to a running-in string for moving said tool within said well casing, a second member operatively connected to said retracted means and movable with respect to said first member, one of said members surrounding the other, one of said members being provided with a longitudinal slot and a circumferential slot disposed substantially entirely in a horizontal position and having a first portion intersecting said longitudinal slot intermediate its length and a second portion intersecting said longitudinal slot at one of its ends, the other of said members being provided with a pin movable along said circumferential and longitudinal slots, and a one-way latch device in said first slot portion shiftable by said pin from its path of movement for permitting passage of said pin from said longitudinal slot into said first slot portion but which prevents retrograde movement of said pin therefrom to lock said normally retracted means in retracted position.

10. A well tool having a body and normally retracted means on said body adapted for outward movement into engagement with a well casing, means for locking said means in retracted position with respect to said body comprising a first member operatively connected to said body

11

and connectable to a running-in string for moving said tool within said well casing, a second member operatively connected to said retracted means and movable with respect to said first member, one of said members surrounding the other, one of said members being provided with a longitudinal slot and a circumferential slot disposed substantially entirely in a horizontal position and having a first portion intersecting said longitudinal slot intermediate its length and a second portion intersecting said longitudinal slot at one of its ends, the other of said members being provided with a pin movable along said circumferential and longitudinal slots, and latch means in said slot portions shiftable by said pin from its path of movement for permitting passage of said pin in one direction only from said second slot portion into said longitudinal slot and from said longitudinal slot into said first slot portion.

11. A well tool having expander means, slips cooperable with said expander means to be moved thereby into engagement with a well casing for anchoring the tool therein against upward movement, means for locking said slips in retracted position with respect to said expander means comprising a first member operatively connected to said expander means and connectable to a running-in string for moving said tool within said well casing, a second member operatively con-

12

nected to said slips and movable with respect to said first member, one of said members surrounding the other, one of said members being provided with a longitudinal slot and a circumferential slot disposed substantially entirely in a horizontal position and having upper and lower portions communicating with said longitudinal slot at different elevations, the other of said members being provided with a pin movable along said circumferential and longitudinal slots, and latch means in said slot portions shiftable by said pin from its path of movement for permitting passage of said pin in one direction only from said lower slot portion into said longitudinal slot and from said longitudinal slot into said upper slot portion.

GEORGE M. ANDERSON.

BERNARD KRIEGLER.

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