Oct. 23, 1945. J. S. McDONALD ET AL 2,387,456

CONTROLLING DEVICE FOR WELL TOOLS

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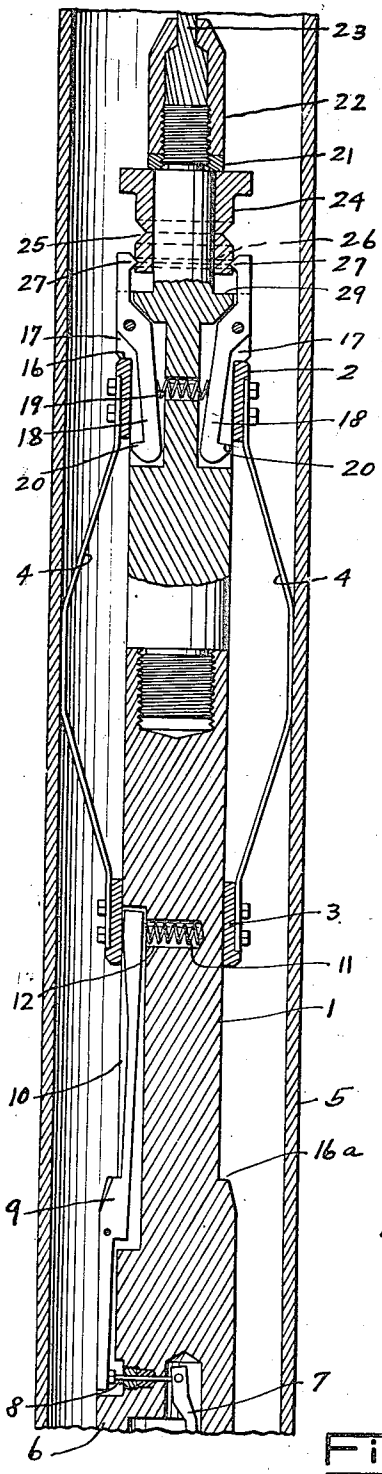


Fig. 1.

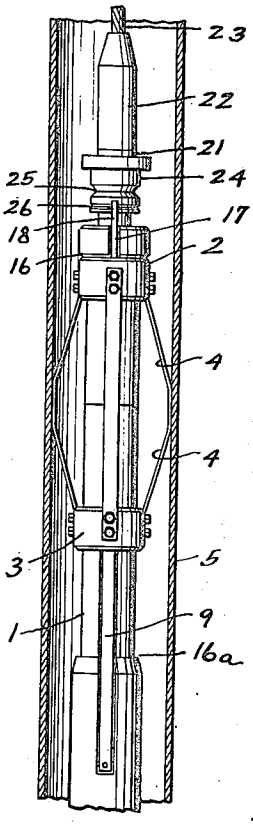


Fig. 3.

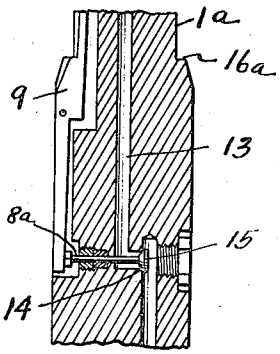


Fig. 4.

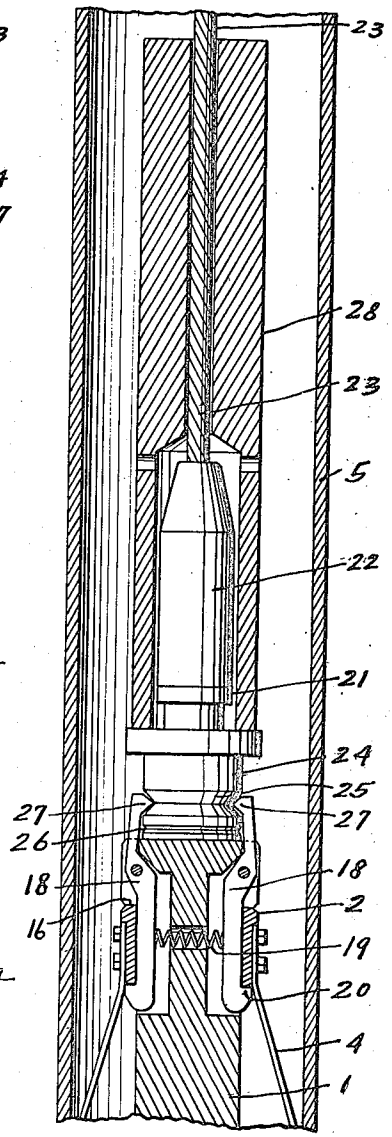


Fig. 2.

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CONTROLLING DEVICE FOR WELL TOOLS

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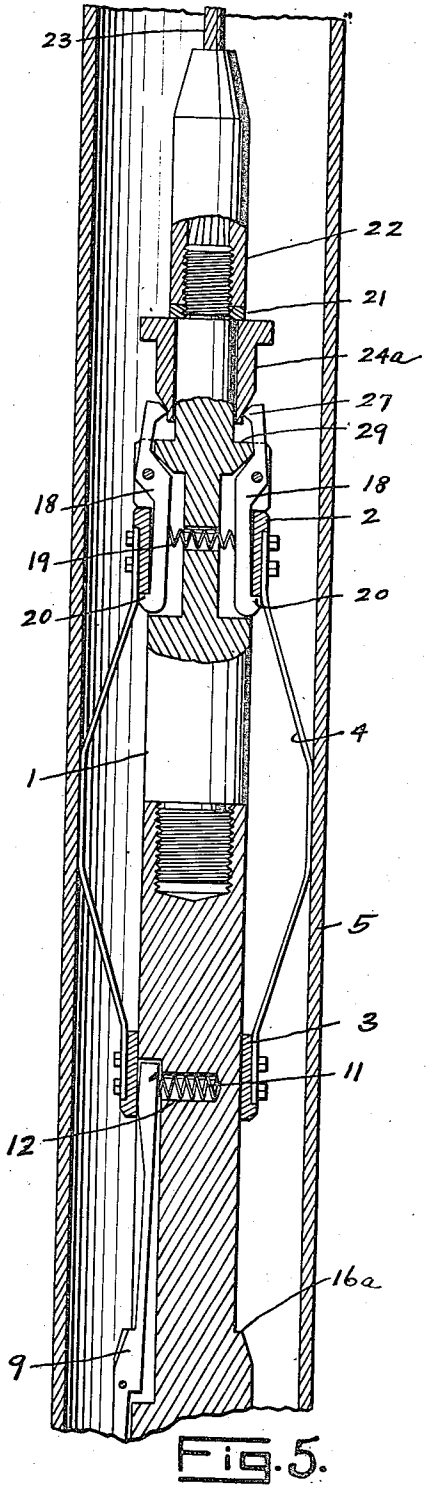


Fig. 5.

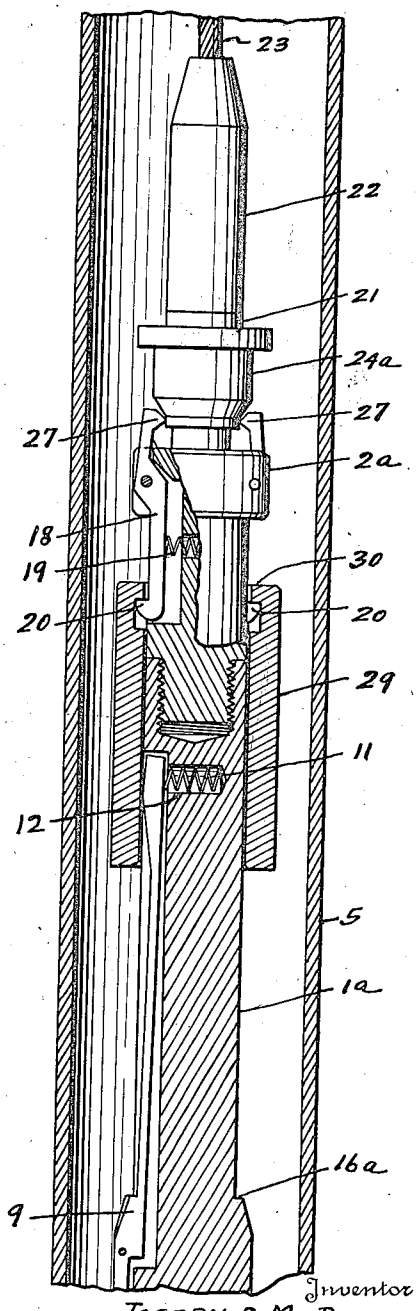


Fig. 6.

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Patented Oct. 23, 1945 2,387,456

UNITED STATES PATENT OFFICE

2,387,456

CONTROLLING DEVICE FOR WELL TOOLS

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Application June 23, 1942, Serial No. 448,112

6 Claims. (Cl. 164—0.5)

This invention relates to locking and unlocking means for a controlling device for wells.

This application-in-part, is a divisional application, a part having been divided out of our copending application for Perforating gun for well casings, Serial No. 359,862, filed October 4, 1940.

An object of the invention is to provide a positive controlling device of the character described specially designed for use in connection with various types of tools for use in wells, such as oil wells and which is of such construction that the tool, or other appliance, to be lowered into the well may be maintained in inoperative position and which may be tripped, or rendered operative, or active, by a selected manipulation, from the ground surface, of the controlling device.

In the practice of using certain types of tool in a well, it is sometimes desirable to lower the tool to a selected depth and then operate the tool and when certain types of said tool are used, it is imperative that once the tool has been set at a selected arrangement of working parts, said arrangement of parts be maintained against any undesired relative movement while locating the tool at the desired depth.

In the present invention, positive means have been provided to lock the operative parts of a tool in predetermined relationship with each other during the process of locating the tool at the desired depth or at least until it is desired to unlock the parts so that the tool can then operate, or be operated, for obtaining or performing the purposes of the tool.

In other instances, it may be desirable to lock the tool inoperative preparatory to its return to the ground surface from the well bore; for example, the tool may have been lowered into the hole, but for safety it is desirable, or even necessary, to make sure that a predetermined relationship of parts be positively maintained and that no untoward movements occur, and that necessary movements, required to move the tool from the hole, will not alter the predetermined relationship of the parts. To accomplish the above purposes, means have been provided for locking said parts against movement while the tool as a whole is being moved from the well bore.

Another object of the invention is to provide a simple type of locking and unlocking means for a tool controlling device of such construction that it may be used with a selected type of tool which is either to be locked or unlocked while in the well, said means being capable of being operated, that is, locked or unlocked, by a single operation.

The invention also includes a guide, which, in one of its forms, may be a frictional engaging device for guiding well tools into the well with means for positively locking or unlocking the same so that it may be maintained against relative movement or allowed relative movement with respect to associated parts.

With the above and other objects in view, the invention has particular relation to certain novel features of construction, operation and arrangement of parts, examples of which are given in this specification and illustrated in the accompanying drawings, wherein:

Figure 1 shows a vertical, sectional view of the device showing the locking levers in released position.

Figure 2 shows a fragmentary, vertical, sectional view showing the controlling device locked in inoperative position.

Figure 3 shows a side elevation, taken at right angles to the view shown in Figure 1.

Figure 4 shows a fragmentary, vertical, sectional view.

Figure 5 shows a vertical, sectional view of another embodiment showing the controlling device locked in inoperative position, and

Figure 6 shows a side elevation, partly in vertical section of another embodiment, showing the controlling device locked in inoperative position.

Referring now more particularly to the drawings wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates the mandrel which is surrounded by the upper and lower collars 2 and 3 slidably mounted on the mandrel and connected by the outwardly bowed springs 4 adapted to frictionally engage the inside of the well casing 5. As illustrated in Figure 1 the lower end of the mandrel may be formed into a housing 6 containing a control lever 7 for operating a tool beneath.

The upper end of the lever 7 has a pivotal connection with the inner end of a radially extended rod 8 which works through a stuffing box in the mandrel forming a seal about said rod, and whose outer end is connected to the lower end of the actuating lever 9. This actuating lever is counter-sunk into an external groove 10 in the mandrel and is pivoted to said mandrel at an intermediate point. The upper end of the lever 9 is seated against a coil spring 11 confined within a socket 12 in the mandrel. When the lower collar 3 is in its upper position, as shown in

Figures 1, 3 and 5, the upper end of the lever 9 will be forced inwardly placing the spring 11 under compression and the lower end of the lever 9 will be held in its outer position thus holding the lever 7 in position to maintain the mechanism to be actuated thereby in a selected position, as, for example, inoperative position.

In the embodiment illustrated in Figure 4 the mandrel 1a may have an axial channel 13 leading therethrough provided with a valve seat 14 which it may be desired to control. With the actuating lever 9 locked in inactive position as shown in Figure 1 the valve 15 on the inner end of the rod 8a will be held against said valve seat to maintain said channel closed.

Upon a release of the actuating lever 9, as hereinafter described, the spring 11 will operate to move the upper end of the actuating lever 9 outwardly which in turn will operate the control 7, of Figure 1 to release the mechanism connected thereto for operation or which will open the valve 15, of Figure 4 to permit circulation of fluid through the channel 13.

The wiper spring assembly is composed of the collars 2 and 3, and the outwardly bowed springs 4. This assembly is limited in its upward movement by the downwardly facing shoulder 16 of the mandrel 1, and is limited in its downward movement by the upwardly facing shoulder 16a of said mandrel.

The upper end of the mandrel has oppositely arranged side slots 17, 17, wherein the locking levers 18, 18, are pivotally mounted and interposed between the lower ends of the levers 18, there is a coil pressure spring 19 tending to press said lower ends apart.

The extreme lower ends of said levers have the external shoulders 20, 20, engagable underneath the upper collar 2, as shown in Figure 2. The extreme upper end of the mandrel 1 is reduced and externally threaded and screwed thereon, there is a ring nut 21 and above the ring nut and screwed on to the mandrel, there is a cable socket 22, whereby the cable 23 may be attached to the controlling device. Slidably mounted on the upper end of the mandrel beneath the ring nut 21 there is a sleeve 24 having the upper and lower external annular grooves 25 and 26, the former of which is of a greater depth than the latter. The upper ends of the levers 18 have inwardly directed detents 27, which when engaged in the lower groove 26 will hold the upper ends of the levers 18 apart with the shoulders 20 retracted inwardly out of engagement with the upper collar 2 as shown in Figure 1.

With the controlling device assembly in the position shown in Figure 1, it may be lowered into the well casing, together with the tool to be operated or controlled attached thereto. The outwardly bowed springs 4 will frictionally engage the inside of the casing and will hold the upper collar 2 against the external annular shoulder 16, formed by the enlargement of mandrel as shown in Figure 1. The lower collar 3 will thus engage upper end of the actuating lever 9 and hold the lower end of said last mentioned lever in its outward position which will, operating through the rod 8 or 8a, hold the control lever 7 inactive or in the embodiment shown in Figure 4, will hold the valve 15 closed.

Assuming, however, that the tool to be operated, or controlled has been lowered into the well to the desired position. The operator may slightly elevate the mandrel 1 by means of the cable 23. The wiper spring 4, however, will hold the collars 2 and 3 stationary during the upward movement of the mandrel and the shoulders 20 will pass up through the upper collar 2 and the upper end of the actuating lever 9 will also move up through the lower collar 3. It will be noted from an inspection of Figures 1 and 5 that the upper end of the actuating lever 9 is widened outwardly and when the outwardly widened portion passes above the collar 3, the upper end of the lever 9 will be forced outwardly by the spring 11 and the lower end will be forced inwardly operating through the rod 8 to move the control lever 7 so that the mechanism may be rendered operative or active; or operating through the rod 8a to open the valve 15.

If it should be desired to lower the tool deeper into the well, the cable 23 may be slacked off and the mandrel moved downwardly relative to the wiper spring assembly until the parts again assume the position shown in Figure 1, whereon the mechanism to be operated can be rendered inactive or the valve 15 closed, and when the desired point has been reached the device may be again operated as hereinabove explained.

If the tool is to be withdrawn from the well it will be desirable to lock the operative mechanism of the controlling device in inactive position. In such event the mandrel should be lowered, as above explained, to the position shown in Figure 1, and a go-devil 28 dropped over the cable which will land on the upper enlarged end of the sleeve 24 and drive the same downwardly into abutting relation with the upwardly facing shoulder 29 of the mandrel, thus unseating the detents 27 from the groove 26 and allowing them to seat in the groove 25, as shown in Figure 2. The lower ends of the levers 18 will thus be free to move apart under the influence of the spring 19, and they will engage underneath the collar 2 as shown in Figure 2, which collar will be locked against longitudinal movement relative to the mandrel between the shoulders 16 and 20 and the lower collar 3 will be held against the widened upper end of the lever 9, thus locking said lever in inactive position.

As illustrated in Figure 5 means have been provided for locking the actuating lever 9 in inactive position so that the tool carried by the controlling device will be inactive while the controlling device is moved up and down in the well, or in any direction or combination of directions. In this form the sleeve 24a has been substituted for the sleeve 24 shown in Figure 1. In order to make the substitution the cable socket 22 and ring nut 21 may be unscrewed and the sleeve 24 removed and the sleeve 24a substituted therefor and the nut 21 and socket 22 then screwed back in place.

The lower end of the sleeve 24a is downwardly tapered so that it will be wedged between the detents 27 holding the upper ends of the levers 18 apart and locking the shoulders 20 underneath the collar 2, which in turn will hold the collar 3 against the widened upper end of the actuating lever 9, as clearly shown in Figure 5. The controlling device with the tool attached may then be moved up and down, up or down, or rotary, or in combination within the casing without operating the tool. When it becomes desirable to operate the tool the go-devil 28 may be dropped over the cable 23 and will land on the enlarged upper end of the sleeve 24. This will operate to drive the sleeve 24a downwardly forcing the upper ends of the levers 18 apart and releasing the shoulders 20 from the collar 2 and upon up-

ward movement of the mandrel 1 the widened upper end of the actuating lever 9 will be released by the collar 3 thus permitting the mechanism to be operated as hereinabove explained.

In the form illustrated in Figure 6, the wiper spring assembly has been dispensed with and in assembling the controlling device before it is lowered into the well, a locking sleeve 29 is assembled over the end of the mandrel 1*a*. The upper end of the locking sleeve has an inwardly extended annular flange 30 which hangs on the shoulders 20, 20 and whose lower end extends down over the upper widened end of the actuating lever 9 so as to hold said upper end in its inner position with the controlling device locked against operation. When it is desired to operate the tool the go-devil 28 may be dropped over the cable 23 and will drive the sleeve 24*a* downwardly, thus expanding the upper ends of the levers 18 releasing shoulders 20 from the flange 30. The locking sleeve 29 will then drop on down and land on the shoulder 16*a*, thus releasing the lever 9 for operation.

The drawings and description are illustrative merely while the broad principle of the invention will be defined by the appended claims.

What we claim is:

1. In a well tool adapted to be used inside of a well bore and comprising a controllable mechanism; an instrumentality for controlling said mechanism, an element, when in one position, maintaining said instrumentality in a predetermined position, said element being movable on the tool and ipso facto effecting change in said instrumentality, when in another position, latch means for holding the element in one position, other means on the tool for operating the latch means to allow said element to move to a predetermined position and non-manual means to move said element to effect a change in the instrumentality.

2. In a well tool adapted to be used inside of a well bore and comprising a controllable mechanism; an instrumentality for controlling said mechanism, an element, when in one position, maintaining said instrumentality in a predetermined position, said element being movable on the tool and ipso factor effecting change in said instrumentality, when in another position, latch means for holding the element in one position, other means for operating the latch means to, ipso factor, automatically lose control of the position of said element and non-manual means to move said element to effect a change in the instrumentality.

3. In a well tool adapted to be used inside of a well bore and including a controllable mechanism; an instrumentality for controlling said mechanism, an element, when in one position, maintaining said instrumentality in a predetermined position, said element being movable on the tool and effecting change in said instrumentality, ipso facto, when in another position, latch means for holding the element in one position, other means on the tool for operating the latch means to, ipso facto, lose control of said element, said element being of sufficient weight to drop upon being released by the latch means.

4. In a well tool adapted to be used inside of a well bore and including a controllable mechanism; means for controlling said mechanism, an element, when in one position, for maintaining said controlling means in a predetermined position, said element being movable on the tool and effecting change in said controlling means when said element moves from original position, latch means, operable by impact, for holding the element in one position, other means on the tool for operating the latch means by impact to release said element and non-manual means to move said element to effect a change in the instrumentality.

5. An article of manufacture for use in subsurface holes comprising a controllable mechanism, said mechanism being capable of being preset; an element of sufficient weight to move by gravity upon being released and for exercising a predetermined degree of control over said mechanism, means for holding said element in one position and means for releasing the holding means to ipso facto allow said element to move by gravity to another position.

6. An article of manufacture for use in subsurface holes comprising a controllable mechanism, said mechanism being capable of being preset; an element for exercising a predetermined degree of control over said mechanism upon being released, means for holding the element in one position, means for releasing the holding means to automatically allow the release of said element for movement to another position and non-manual means to move said element to said other position.

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