

[54] **POSITIONING TOOL**
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[22] **Filed: Nov. 17, 1971**
[21] **Appl. No.: 199,439**

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[52] **U.S. Cl.**..... 166/214, 166/237, 166/243
[51] **Int. Cl.**..... **E21b 23/02**
[58] **Field of Search**..... 166/117.5, 117.6,
166/206, 214, 216, 237, 243

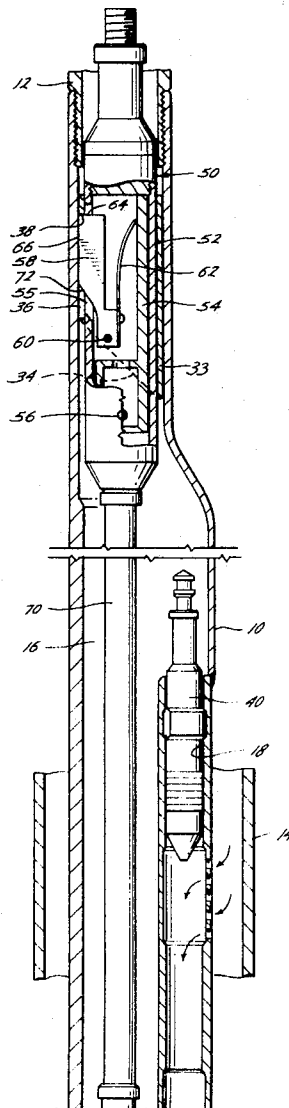
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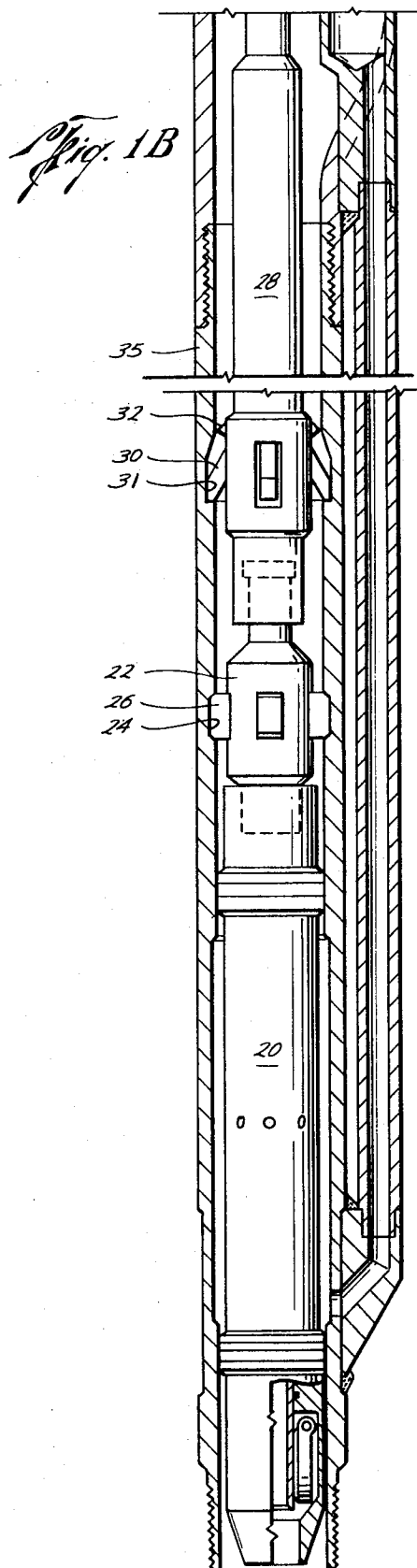
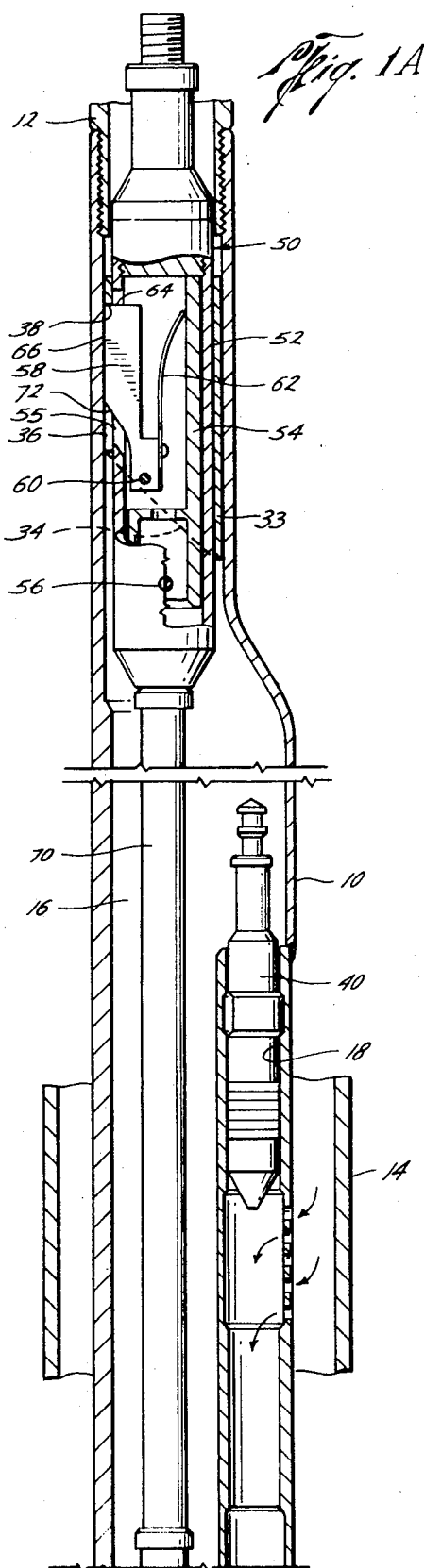
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[57] **ABSTRACT**

A positioning tool equipped with a pivoting locating finger which is actuated by engagement with an extended linear slot whose upper end is closed in a well tubing for placing well equipment in the precise position for setting in a well tubing thereby avoiding prematurely setting the well equipment at an undesired location in the tubing. The finger having a radial extending edge the longitudinal length of which is greater than the normal recesses in the well tubing whereby the finger may avoid the recesses and shoulders used to actuate the well equipment, and a spacer support supporting the well equipment desired to be actuated for positioning the well equipment when the locator finger engages the extended linear slot.

1 Claim, 2 Drawing Figures





POSITIONING TOOL

BACKGROUND OF THE INVENTION

In many instances it is desired to set well equipment in a well tubing which require actuation by longitudinal upward and downward movement through the tubing in which the actuation is accomplished by engagement of the well equipment with various shoulders and recesses in the well tubing. However, since the well tubing may have many shoulders and recesses therein, the well equipment may be actuated at an undesired location.

For example only, assuming that it is desired to set a Camco B-5 safety valve in a KMPO-W mandrel, a running tool such as a Camco W-1 running tool may be used to actuate a conventional well lock in the mandrel for properly locating the safety valve. However, the running tool is actuated by an upward movement in which releasable pawls contact a downwardly directing shoulder to release the setting dogs on the running tool which in turn engage a recess and an upwardly directed shoulder whereby a jarring action will actuate the locking dogs of the well lock which engage another recess for locking in the well tubing. Obviously, with a plurality of shoulders and recesses in the mandrel and well tubing, the running tool may be actuated prematurely at some undesired location and prevent proper placement of the well lock and safety valve.

The present invention is directed to providing a positioning tool which will precisely position well equipment in a well tubing for properly setting the well equipment in the proper location.

SUMMARY

The present invention is directed to a positioning tool equipped with a pivoting locating finger which is stopped from upward vertical movement after positioning in an extended linear slot in a well tubing whose upper end is closed by a shoulder.

A positioning shoulder having a locator finger pivotally supported and having an upwardly directed shoulder with the finger having a radial extending edge the longitudinal length of which is greater than the length of recesses in the well tubing whereby the locator finger will only be engaged by an extended linear slot, and a spacer support connected to the locator finger and supporting other well equipment whose precise location in the well bore may be located relative to a shoulder in the extended linear slot.

A positioning tool having a pivoting locator finger which includes a portion tapered inwardly and downwardly below this extended longitudinal edge for bypassing upwardly directed shoulders in the well bore.

Yet a still further object of the present invention is the provision of a positioning tool for properly locating a running tool having releasable pawls which are actuated by contacting a downwardly directed shoulder in a well tubing and release setting dogs which contact an upper directed shoulder, in a mandrel in a well tubing which mandrel includes an open bore aligned with the tubing and includes an offset sidepocket, and the mandrel includes a linear slot having a shoulder at the top thereof and the open bore includes a plurality of shoulders and adjacent recesses whereby the locator finger will engage the extended linear slot and will avoid the plurality of shoulders and recesses to precisely locate the positioning tool for actuation and setting of a well lock in the open bore of the mandrel.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a fragmentary elevational view, partly in cross section, of the upper portion of a mandrel in a well tubing illustrating the positioning tool of the present invention, and

FIG. 1B is a continuation of FIG. 1A illustrating the setting of a running tool, well lock and safety valve in the mandrel.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention will be described, by way of example only, as positioning a running tool and well lock in a mandrel although it will be understood that the positioning tool of the present invention is useful in locating other types of well equipment in other positions of a well tubing.

Referring now to the drawing, a mandrel 10 such as a Camco KMPO-W mandrel is shown in position in a conventional well tubing 12 in a casing 14. The mandrel 10 conventionally includes an open bore 16 and a sidepocket 18 offset therefrom. Assuming that it is desired to seat a safety valve 20, such as a Camco type B-1 safety valve in the open bore 16, the valve 20 will normally be secured in place by a conventional well lock 22. The lock 22 is secured in the bore 16 in recessed notches 24 by locking dogs 26 and is actuated into a locking relationship by a conventional running tool 28 such as a Camco W-1 running tool, such as more fully described in U.S. Pat. No. 3,446,281. The running tool 28 includes setting dogs 30 which are released by pawls 32. The pawls 32 will be actuated by engagement with a downwardly directed shoulder in the well tubing on upward movement of the setting tool 28 and thereafter on downward movement of the running tool 28 the now released locking dogs 30 will engage a recessed notch 31 for actuating and setting the well lock 22. It is to be noted that there are various shoulders and recesses in the mandrel 10 as well as in a conventional well tubing 12. Therefore, unless the running tool 28 is properly located prior to its setting and the actuation of the well lock 22, the setting tool 28 and well lock 22 may be prematurely set at some undesired location in the tubing 12 or mandrel 10.

The mandrel 10 also includes an orientation sleeve 33 which has a helical guide surface 34 which leads into an elongated linear slot 36 with a downwardly directed shoulder 38 at the top of the slot 36 which blocks the slot 36. The helical surface 34 and groove 36 and shoulder 38 may act as an orientation sleeve for setting elements such as valve 40 in the sidepocket 18 of the mandrel 10 as more fully disclosed in copending patent application Ser. No. 95,408.

The present invention is directed to the provision of a positioning tool which will accurately position the running tool 28 and attached well lock 22 for actuation in the bore 16 wherein the positioning tool will avoid engaging all of the shoulders and recesses in the bore 16 with the exception of the extended longitudinal slot 36 and shoulder 38.

The positioning tool is generally indicated by the reference numeral 50 and may include an outer body 52 and an inner body 54 slidable in the body 52 except for the provision of a shear pin 56 locking the two bodies together. The outer body 52 includes a window 55. A locator finger 58 is pivotally supported adjacent its

lower end by a safety pin 60 to the body 54 and is normally urged out of the window 55 by a spring 62. The finger 58 includes an upwardly directed shoulder 64 for engagement with the downwardly directed shoulder 38. The finger 58 includes a radially extending edge 66 the longitudinal length of which is greater than the other recesses in the well bore such as notches 31 and 24 and the conventional one inch spacing between tubing joints of the tubing 12 whereby the locator finger 58 will not become positioned in the recesses and thus the shoulder 64 will not engage any of the shoulders adjacent the recess. However, the shoulder 64 of the locator finger 58 will engage the helical surface 34 and the slot 36 upon upward movement so the locator finger shoulder 64 will contact shoulder 38. Since the orientation sleeve 33 and shoulder 38 are at a fixed distance from the nipple 35 in which the running tool 28 is desired to be located, an appropriately spacer support 70 is connected to the positioning tool 50 for supporting the running tool 28 and will place the running tool 28 in the precise position for actuation when the locator finger shoulder 64 abuts the shoulder 38.

The locator finger 58 includes a downwardly and inward taper 72 whereby the locator finger 58 will readily move down the open bore 16 past any obstructions for carrying the running tool 28, well lock 22 and safety valve 20 to the proper location in the open bore 16 of the mandrel 10. On upward movement of the assembly, such as by wireline or by hydraulic pumping, the locator finger 58 will contact the guide 34 of the orientation sleeve 33 and be directed into the longitudinal slot 36 until the finger shoulder 64 abuts the slot shoulder 38. At this position, the running tool 28 is properly positioned in the nipple 35 and may be lowered a slight distance and raised so that the releasable pawls 32 will contact a downwardly directed shoulder thereby releasing the setting dogs 30 of the well lock 28. Again, upper movement of the tool 50 into the 36 will raise the setting dogs above the setting recessed notch 31, but below the sidepocket 18 so that the dogs 30 will not engage the upper end of the sidepocket 18. Further downward movement of the positioning tool 50 will carry the setting tool 28 so that the setting dogs 30 will engage the notch 32 and properly position the setting tool 28 and the well lock 22 so that the locking dogs 26 on the well lock 22 may be actuated and set in the recessed locking notches 24 thereby setting the safety valve 20 at the proper location.

The setting tool 28 is then conventionally released from the well lock 22 and upward movement of the po-

sitioning tool 50 will again engage the locator finger 58 into the slot 36. Upper jarring of the positioning tool 50 will shear pin 56 allowing the body 54 to move downwardly with respect to the body 52 thereby retracting the locator finger 58 within the body so that the positioning tool 50 may be conveniently removed from the tubing 12. If any difficulty is encountered in shearing the pin 56, an additional upper jar may be taken to shear the safety pin 60.

The present invention, therefore, is well adapted to carry out the objects and attain the ends and advantages mentioned as well as others inherent therein. While a presently preferred embodiment of the invention is given for the purpose of disclosure, numerous changes in the details of construction and arrangement of parts will readily suggest themselves to those skilled in the art and are encompassed within the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. A tool for correctly locating a safety valve in a mandrel in a well tubing, said mandrel including an open bore aligned with the tubing and including an off-set sidepocket, said mandrel including an orientation slot having a shoulder at the top thereof and having an upwardly directed shoulder and locking recess in the open bore comprising,

a positioning tool having a body and including a locator finger pivotally supported adjacent its lower end to the body and having an upwardly directed shoulder, and spring means yieldably urging said finger outwardly,

a running tool having releasable pawls which are actuated by contacting a downwardly directed shoulder in the well tubing, and including setting dogs which are actuated outwardly by the releasable pawls for engaging the upwardly directed shoulder, a well lock carried by the running tool and having locking dogs for engaging the locking recess in the open bore, said well lock actuated by the running tool,

a safety valve connected to and supported by the well lock, and

an elongate spacer support connected to the body of the positioning tool and supporting the running tool and of a length for correctly positioning the running tool and well lock in the open bore for setting the well lock when the locator finger engages the shoulder at the top of the elongate slot.

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