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McGowen, Jr., deceased

[11] **3,874,447**

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[54] **COLLET LATCH FOR RELEASABLY LOCKING A FLOW CONTROL DEVICE IN THE POCKET OF A WELL MANDREL**

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[52] **U.S. Cl.** **166/214,** 166/217, 294/86.18

[51] **Int. Cl.** **E21b 23/02**

[58] **Field of Search** 166/214, 215, 217; 294/86.18, 86.31, 86.33

[56] **References Cited**

UNITED STATES PATENTS

3,126,059	3/1964	Fredd	166/217
3,638,988	2/1972	Brown	294/86.18
3,741,601	6/1973	Dudley	294/86.18
3,827,493	8/1974	Terral	166/215

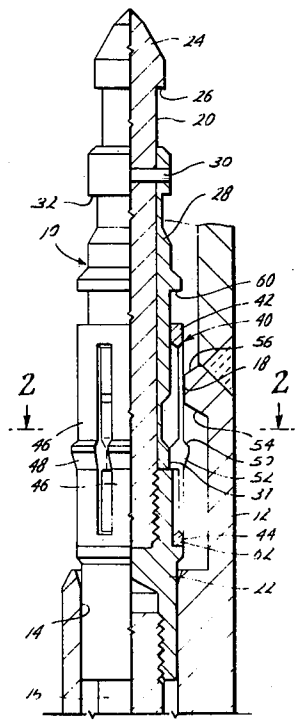
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[57] **ABSTRACT**

A collet latch for releasably locking dummies and control gas lift valves in the pocket of a well mandrel in which the mandrel includes a locking shoulder above the pocket. The latch includes a stem, a sleeve telescopically movable relative to the stem, and the sleeve includes a recess in its exterior surface intermediate its ends. The collet latch is slidable on the sleeve and includes a collar at each end with flexible spring ribs connected between the collars with a locking lug connected to and extending outwardly from each rib and having cam surfaces for coacting with the locking shoulder. Upper and lower stop means are provided for limiting the longitudinal movement of the collet latch relative to the sleeve between a first upper position for positioning the lugs adjacent the sleeve recess, and a bottom position for positioning the lugs away from the recess.

11 Claims, 4 Drawing Figures



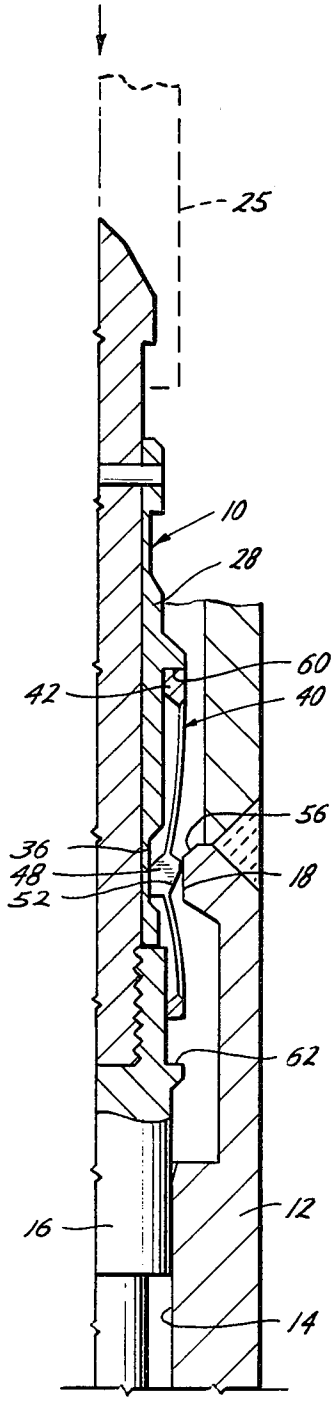


Fig. 3

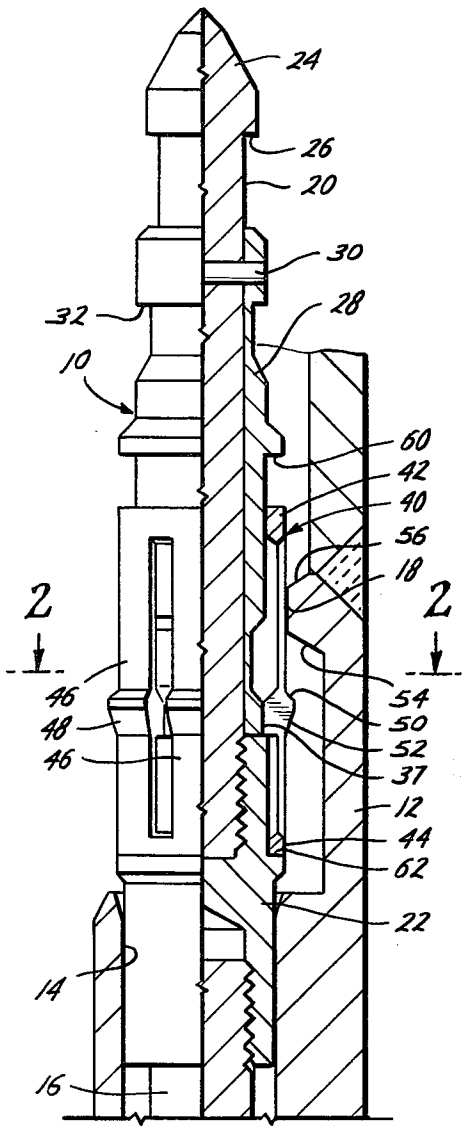


Fig. 1

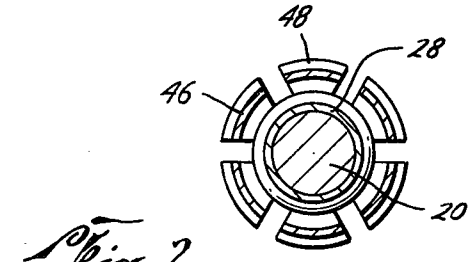


Fig. 2

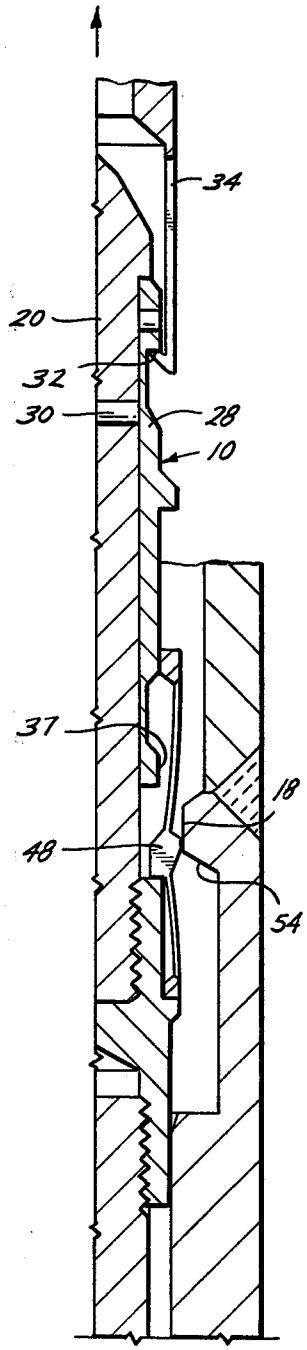


Fig. 4

COLLET LATCH FOR RELEASABLY LOCKING A FLOW CONTROL DEVICE IN THE POCKET OF A WELL MANDREL

BACKGROUND OF THE INVENTION

One type of collet latch is shown in U.S. Pat. No. 3,741,601 in which the collet has downwardly directed cantilevered fingers. However, such latches, with the free ends of the fingers extending downwardly, have been subject to being bent outwardly as the latch is moved downhole in the well conduit by being caught on obstructions in the well bore which prevent the latch from locking. In addition, the free ends of the downwardly extending fingers have been caught on oil well equipment moving uphole through the well tubing thereby interfering with the operation of well equipment being moved through the tubing. Of course, if the fingers are bent outwardly into the main bore of the mandrel, they will interfere with the passage of well equipment through the mandrel.

The present invention is directed to an improved collet latch using a collet cage that eliminates free ends thereby overcoming the disadvantages of the prior devices.

SUMMARY

The present invention is directed to a collet type latch for releasably locking a flow control device, such as a dummy or gas lift valve, in the sidepocket of a mandrel in a well tubing for holding the flow control device in place, but allowing the flow control device to be removed when desired.

The present invention is directed to an improvement in a latch for releasably locking a flow control device in a mandrel which includes a locking shoulder. The latch includes a stem, a sleeve telescopically movable on the stem and including a first surface such as a recess and a second surface such as a shoulder. A collet latch is provided slidably movable relative to the sleeve exterior and the collet latch includes a collar at each end with a plurality of flexible spring ribs connected between the collars. A locking lug is connected to and extends outwardly from each rib and includes cam surfaces for coacting with the locking shoulder. Upper and lower stop means are provided for limiting the longitudinal movement of the collet latch relative to the sleeve between a first upper position and a second bottom position. The upper stop means positions the lugs adjacent the sleeve recess whereby the lugs may move into a first retracted position in the recess and bypass the locking shoulder on downward movement. The lower stop positions the lugs out of registry with the recess and in a second locking position against the sleeve for preventing inward movement of the locking lugs thereby preventing upward movement of the lugs past the locking shoulder for locking the latch in position. Upper movement of the sleeve relative to the stem removes the backup from the locking lugs allowing the lugs to move to a retracted position and allowing the latch to be released from the mandrel.

It is a further object of the present invention in which the collet latch securely holds both ends of the flexible spring ribs preventing their engagement with obstructions in the well bore and from being bent out of place causing the latch to be inoperative or create obstructions in the well bore.

Other and further features and advantages will be readily apparent form the following description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a fragmentary elevational view, partly in cross section, illustrating the improved collet latch of the present invention in locked position in a well mandrel,

FIG. **2** is a cross-sectional view taken along the line **2—2** of FIG. **1**,

FIG. **3** is a fragmentary elevational view showing the improved latch of the present invention being inserted into the pocket of a well mandrel, and

FIG. **4** is a fragmentary elevational view, illustrating the latch of the present invention being removed from the mandrel.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, particularly to FIG. **1**, the reference numeral **10** generally indicates the latch of the present invention in a sidepocket mandrel **12** having a pocket **14** for receiving a flow control device **16**, such as a dummy or gas lift valve, thereby releasably securing the valve **16** in the pocket **14** as generally described in connection with FIGS. **17** through **22** of U.S. Pat. No. 3,074,485. The mandrel **12** includes a locking shoulder **18**, which may be arcuately or circularly shaped, for coacting with the latch **10** for releasably securing the latch **10** in place. The setting and retrieving of the valve **16** and latch **10** may be suitably performed by any conventional tools such as that described in U.S. Pat. No. 3,074,485.

The present latch **10** includes a stem **20** threadably secured at its lower end to the flow control device **16** such as by an adapter **22.** The upper end of the stem **20** is provided with a pointed head **24** of larger diameter than the stem **20** for providing a shoulder **26** for engagement with a running tool **25** (FIG. **3**). A locking sleeve **28** is slidably mounted on the stem **20,** but is initially and temporarily secured in its lowermost position against the upper end of the adapter **22** by means of a shear pin **30.** The upper end of the sleeve **28** includes a shoulder **32** for engagement with a pulling tool **34** (FIG. **4**) for shearing the pin **30** and moving the sleeve **28** upwardly relative to the sleeve **20** for releasing the latch **10** as will be more fully described hereinafter.

The exterior surface of the sleeve **28** includes a first surface such as recess **36** intermediate the upper and lower ends of the sleeve **28** and includes a second surface such as shoulder **37.**

The present invention is directed to providing an improved collet latch generaly indicated by the reference numeral **40** which includes a plurality of flexible spring ribs **46** disposed adjacent the sleeve **28** which generally extend in a substantially parallel relationship with each other. A locking lug **48** is connected to and extends outwardly from each of the ribs **44** and is preferably positioned intermediate the ends of the ribs. Each of the locking lugs **48** includes upwardly directed and downwardly directed cam surfaces **50** and **52,** respectively, for coacting with cam surfaces **54** and **56,** respectively, of the locking shoulder **18** on the mandrel **12.** The locking lugs **48** are movable to and from a first retracted position relative to the stem **20** such as in the recess **36** in the sleeve **28** for enabling desired radial

movement of the locking lugs **48** past the locking shoulder **18** and a second locking position adjacent the shoulder **37** on the sleeve **28** for engaging the locking shoulder for locking the flow control device **16** in the pocket **14** of the mandrel **12.** Means are provided such as a first upper collar **42** and a second lower collar **44** for connecting the ends of the ribs **46** together to hold the ends of the ribs **46** from inadvertent engagement from obstructions in the well bore as the latch **10** moves through the bore to and from the pocket **14** of the mandrel **12.** The collars **42** and **44** are slidable on the exterior of the latching sleeve **28** and adapter **22.**

Upper and lower stop means are provided for limiting the longitudinal sliding movement of the collar latch **40** relative to the sleeve **28.** Upper stop means **60** on the sleeve **28** limits the upper movement of the collet latch **40,** as best seen in FIG. **3,** to position the locking lugs **48** in a first retracted position adjacent and in the sleeve recess **36** for allowing the lock **10** to move downwardly past the locking shoulder **18.** A lower stop shoulder **62** is provided, such as on the adapter **22,** for limiting the downward movement of the collet latch **40** for positioning the locking lugs **48** out of registry with the recess **36** and in a second locking position against a locking surface **37,** as best seen in FIG. **1,** to prevent inward movement of the locking lugs **48** for locking the latch **10** in position as shown in FIG. **1.**

In operation, referring to FIG. **3,** the collet latch **40** is slidably supported on the sleeve **28** between the shoulders **60** and **62.** A running tool **25** is releasably connected to the head **24** of the end **20** for moving the flow control unit **16** into the sidepocket **14** of the mandrel **12,** as is conventional. As the flow control unit **16** is inserted and moved downwardly in the pocket **14,** the locking lugs **48** adjacent the mandrel locking shoulder **18** will contact the shoulder **18** with the shoulder surface **56** contacting the locking lug cam surface **52** causing the collet latch **40** to slide upwardly relative to the sleeve **28** until the locking lugs **48** are aligned with the recess **36** when the upper collet **42** contacts the upper shoulder **60.** Further downward movement of the latch **10** and the caming action between the surfaces **56** on the locking shoulder **18** and the surface **52** on the locking lugs **48** moves the locking lug **48** into a first retracted position in the recess **36** allowing the latch **10** to be moved downwardly carrying the locking lugs **48** past the shoulder **18** and seating the flow control unit **16** in the pocket **14.**

Referring now to FIG. **1,** upward movement of the latch **10** will bring the caming surface **54** on the locking lugs **48** into contact moving the collet latch **40** downwardly to a bottom position with the lugs **48** positioned out of the recess **36** and into a second locking position against the lower end **37** of the sleeve **30** where they are prevented from moving inwardly thereby locking the latch **10** in position. The pulling tool **25** is released by an upward jar as is conventional.

When it is desired to remove the latch **10,** a pulling tool **34,** as best seen in FIG. **4,** is conventionally moved downhole to grab the shoulder **32** of the sleeve **28.** An upward pull by the pulling tool **34** will shear the pin **30** causing the sleeve **28** to move upwardly relative to the stem **20** and removing the lower end **37** of the sleeve **28** from behind the locking lugs **48.** Further upward movement of the latch **10** by the pulling tool **32** brings the cam surface **50** on the locking lugs **48** into contact with the cam surface **54** on the locking shoulder **18** causing the locking lugs **48** to cam inwardly into a retracted position and move upwardly past the shoulder **18.**

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 which are encompassed within the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. A new and improved latch apparatus for releasably locking a flow control device movable through the bore of a well conduit to a mandrel for locking in the pocket of the mandrel below a locking shoulder of the mandrel, and in which the latch apparatus includes a stem and a sleeve movably mounted about the stem for coacting with a latch means to effect operation of the latch means, the improvement in the latch means comprising,

a plurality of flexible ribs disposed adjacent the sleeve, each of said plurality of ribs having a locking lug mounted therewith at a location intermediate the ends of each of said plurality of ribs;

said plurality of locking lugs movable to and from a first retracted position relative to the stem for enabling desired movement of said plurality of locking lugs past the locking shoulder and a second locking position for engaging the locking shoulder for locking the flow control device in the pocket of the mandrel; and

means for connecting the ends of said plurality of ribs together to hold the ends from inadvertent engagement from obstructions in the well bore as the latch means moves through the bore to and from the pocket of the mandrel.

2. The apparatus as set forth in claim **1,** wherein:

said plurality of locking lugs are circumferentially spaced about the exterior of the sleeve with each of the ribs extending in substantially parallel relationships with each of the other of said plurality of ribs.

3. The apparatus as set forth in claim **1,** wherein:

each of said plurality of locking lugs move radially outwardly from the stem in moving from the first retracted position to the second locking position.

4. The apparatus as set forth in claim **1,** wherein:

said means for connecting the ends of said plurality of ribs arranged to move said plurality of locking lugs on the sleeve to and from a first surface formed on the sleeve for enabling movement of said plurality of locking lugs to the first retracted position and a second surface for holding said plurality of locking lugs in the second locking position for locking the flow control device in the mandrel by engagement with the locking shoulder.

5. The apparatus as set forth in claim **4,** wherein:

the sleeve is moved relative to the stem to move the second surface from holding said plurality of locking lugs in the second locking position for enabling movement of said locking lugs to the first retracted position to release the flow control device for movement from the mandrel.

6. The apparatus as set forth in claim **4,** wherein said means for connecting includes:

a first collar means movable relative to the sleeve;
a second collar means movable relative to the sleeve and spaced from the first collar; and
each of said plurality of ribs having one end connected with said first collar means and the other end connected with said second collar means wherein said first and said second collars connect the ends of said plurality of ribs.

7. The apparatus as set forth in claim **6,** wherein:
said plurality of locking lugs circumferentially spaced about the exterior of the sleeve with said ribs extending in substantially parallel relationships between said first collar means and said second collar means.

8. The apparatus as set forth in claim **7,** wherein:
each of said plurality of flexible ribs arranged for urging said locking lugs mounted thereon to move to the second locking position.

9. The apparatus as set forth in claim **8,** wherein:
each of said plurality of ribs flexing to enable movement of said locking lug mounted thereon to the first retracted position when said locking lug engages an obstruction in moving through the well bore to the pocket.

10. The apparatus as set forth in claim **9,** wherein:
said first and said second collar means moving said plurality of ribs relative to said sleeve when an obstruction is engaged by said locking lugs when moving through the well bore to the pocket to enable movement of said locking lugs to the first retracted position to enable movement of the flow control device to the pocket.

11. In a latch for releasably locking a flow control device in the pocket of a mandrel in which the mandrel includes a locking shoulder above the pocket, and in which the latch includes a stem, a sleeve telescopically movable on the stem and releasably connected thereto, said sleeve including a recess in its exterior surface intermediate its ends, the improvement in a collet latch comprising,

a collet latch slidable relative to the sleeve, said latch including a collar at each end with flexible spring ribs connected between said collars;
a locking lug connected to and extending outwardly from each rib and having upwardly and downwardly directed cam surfaces; and
upper and lower stop means for limiting the longitudinal movement of the collet latch relative to the sleeve between a first upper position for positioning the lugs adjacent the sleeve recess, and a bottom position for positioning the lugs away from the recess but against the sleeve, whereby when the latch is moved past the locking shoulder the lugs will be pushed upwardly by the locking shoulder into the sleeve recess allowing passage of the latch past the locking shoulder after which the lugs will, by upward movement of the latch, be moved downwardly away from the recess and against the sleeve and locked in place.

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