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Read et al.

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[54] **LATCH OR RETRIEVABLE WELL PACKER**

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[73] Assignee: **Dresser Industries, Inc.**, Dallas, Tex.

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[52] **U.S. Cl.** **166/134,** 166/138, 166/240

[51] **Int. Cl.** **E21b 23/06,** E21b 33/129

[58] **Field of Search** 166/237, 240, 138, 166/210, 211, 216, 217, 140

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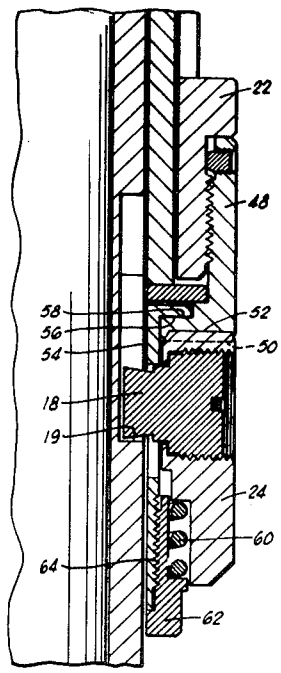
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[57] **ABSTRACT**

A selectively engageable clutch connecting the mandrel to the friction device allows residual torque in the tubing to rotate through a well tool, such torque having resulted from greatly exaggerated movements of the tubing at the surface of the well bore used in activating a latch mechanism in a packer at considerable depth in the well bore.

14 Claims, 3 Drawing Figures



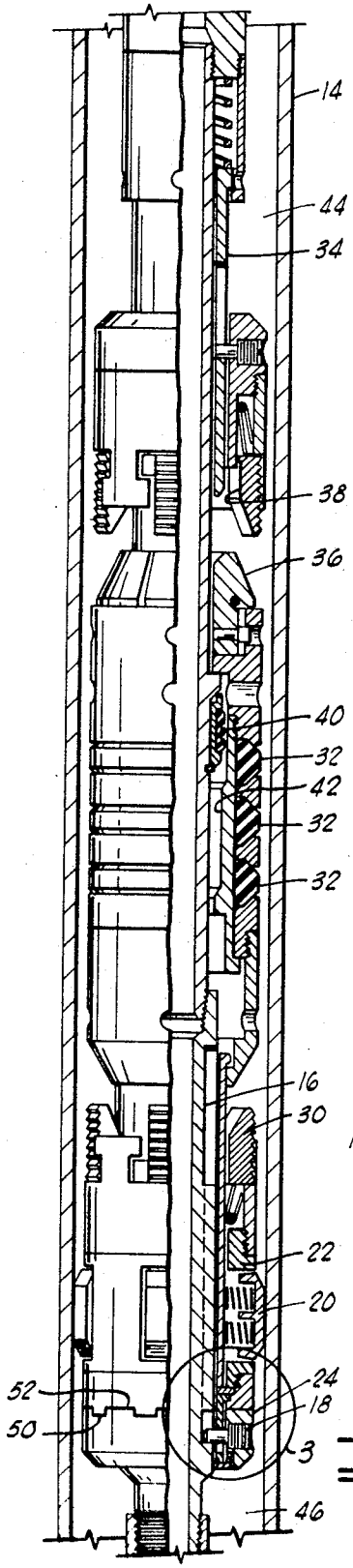


FIG. 1

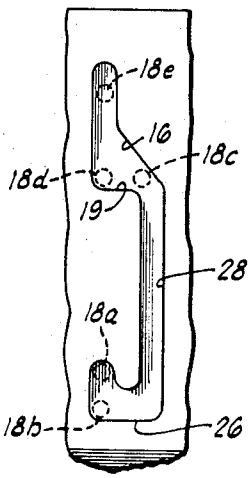


FIG. 2

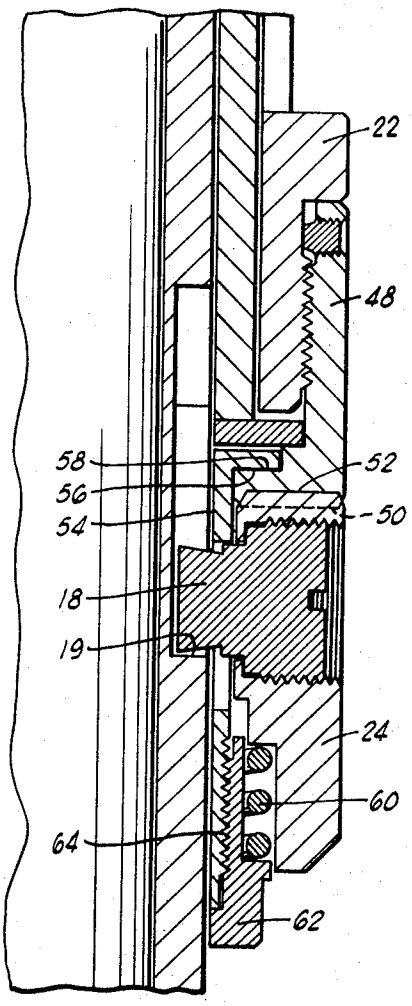


FIG. 3

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LATCH OR RETRIEVABLE WELL PACKER

BACKGROUND OF THE INVENTION

The field of invention relates to well tools in general and to well packers in particular. Mechanically operated well tools frequently have latches or jay-slots to maintain the packer in a retracted position while being lowered to setting depth in the well. Reciprocation and/or rotation of the tubing at the surface is used to unlatch the mechanism and release the packer so that it may be set by vertical movement of the tubing string.

Prior art is described in U. S. Pat. No. 3,416,608 which describes one form of a retrievable well packer using a jqy-slot with locking positions at both ends of the jay-slot. The locked position at one end of the jay-slot holds the packer in retracted position so that it may be lowered to setting depth in the well bore. Once the packer is at depth, the jay-pin is released from the running-in position and the packer is set by engaging the jay-pin with a shoulder to hold the packer in set position.

Difficulty has been experienced with prior art devices in putting sufficient right-hand torque into the tubing at the surface wherein it is necessary to first rotate the jay-latch out of running-in position and allow setting of the packer and still have sufficient freedom of movement of the jay-slot with respect to the jay-pin to allow the longitudinal relative movement, and then to rotate the jay-slot back to the left to position the jay-pin in engaged position with a shoulder in the jqy-slot which will hold the packer in set position.

This difficulty has been experienced despite the fact that, ordinarily, steel is considered to be a very stiff material and it is relatively stiff as used i many objects ordinarily encountered. In a tubing string in a well, however, steel exhibits rather pronounced elastic characteristics. In a string of tubing suspended in a well in air so that there is no liquid to buoy the tubing, a 10,000 foot string of steel tubing will stretch approximately 66 inches just due to its own weight. In setting the various packers of the types known in the art, it is common practice to leave as much as 15,000 pounds of tubing weight exerted down on the packer. Once the packer is set and can support tubing weight, 2⅜ inches outside diameter 4.7 lb./feet A.P.I. tubing at the surface must be lowered approximately 43 inches in order to transfer 15,000 pounds of the tubing weight to the packer and leave the balance of the tubing weight suspended from the surface of the well bore. It can be seen, therefore, that elasticity of a steel tubing string and tension can mask the operation of well tools at the bottom of a well bore, especially in operating a jqy-latch or the like.

Steel also exhibits elasticity when torque is applied. A tubing string, according to the example above, will twist approximately 1¼ turns when 100 foot pounds of torque is applied to the surface if the bottom of the tubing string is restrained from rotation. This torque is easily applied with a commonly used 36 inch pipe wrench with only 33 pounds of force applied at the end of the pipe wrench handle. Such a torque is commonly required to operate a jqy-slot. Therefore, 1¼ turns of twist in the tubing plus another ¼ turn required to operate the jqy-slot can result in 1½ turns of the tubing at the surface to achieve ¼ turn for activation of the jay-latch at the bottom of the well. Additional frictional resistance caused by contact of the tubing with the casing throughout the length of the tubing string will cause additional friction and it often happens that 2 or 3 turns of the tubing at the surface are required to cause ¼ turn of the tubing to activate the jay-latch in a tool at the bottom of a 10,000 foot well.

It is therefore a primary object of this invention to provide an arrangement to facilitate operation of well tool latches.

It is a further object of this invention to provide a clutch in a well tool to facilitate operation of well tool latches.

It is a further object of this invention to provide an improved well tool latch which substantially eliminates residual torque in well tubing.

It is a further object of this invention to provide a clutch in a well tool which allows twist in a tubing string to be relieved without affecting operation of a latch mechanism in the well tool.

SUMMARY OF THE INVENTION

These and other objects of this invention are fulfilled by an improved well tool to be run on tubing and set in casing, the tool having a mandrel, a support for gripping the casing, friction means, a latch between the mandrel and the support with the improvement of a clutch connecting the mandrel to the friction means to allow residual torque to be released through the well tool by rotation of the tubing and the mandrel.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view, partially in elevation and partially in section, of a well tool according to this invention.

FIG. **2** is a partial elevation view of the jay-slot of the packer shown in FIG. **1.**

FIG. **3** is an enlarged portion of FIG. **1** enclosed in the circle.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1,** the packer according to this invention is shown connected to a tubing string, not shown, so the packer may be lowered to setting depth to be set in casing **14** in a manner described more completely in U. S. Pat. No. 3,416,608.

Briefly, the packer is held in retracted position by jay-slot **16** and the cooperating jay-pin **18.** Friction pads **20** create a drag between the casing **14** and housing **22** which is connected to jay-pin housing **24** so that jay-pin **18** will be restrained from movement by the frictional engagement of friction pads **20** to casing **14.** Such restraint on jay-pin **18** makes possible relative movements of jay-slot **16** to jay-pin **18** by manipulation of the tubing string connected to jay-slot **16.**

In order to release jay-pin **18** from its latched or running-in position in jay-slot **16,** the packer is run to a depth below the desired setting depth. The running-in position of jay-pin **18** is shown in FIG. **2** by the dotted circle designated **18***a*. Then as the tubing is raised to lift the packer to the desired setting depth, the end **26** of jay-slot **16** engages jay-pin **18** at position **18***b*. Then right-hand rotation of the tubing at the surface causes jay-slot **16** to be rotaed to the right with respect to jay-pin **18** and the jay-slot will move so that the long section **28** in the jay-slot is aligned with jay-pin **18.** Then the tubing is lowered at the surface, causing lower slips **30** to grip casing **14** forming a support so that packing elements **32** are supported and weight from the tubing may be imposed on packing elements **32** compressing

them into sealing engagement with casing **14**, and lowering jay-slot **16** until the jay-slot **16** engages jay-pin **18** as shown at dotted circle **18c**. Continued downward movement of the tubing at the surface will disengage the clutch and relatively move jay-pin **18** to the position shown in dotted circle **18*d***. Further down stroking of the tubing will complete the setting of the packer. Tubular sleeve **34** is moved downwardly expanding segmented conical sections **36** so that upper slips **38** are expanded into gripping engagement with the inside diameter of casing **14**. Valve seal **40** seals in seal bore **42** completing the pack-off between annulus **44** above the packer and annulus **46** below the packer.

It should be understood that packers with gripping elements other than those shown are operable with the present invention.

Referring now to FIG. **3**, there is shown an enlarged view of the portion shown in the circle **3** of FIG. **1**. Body **22** which contains and supports friction pads **20** (not shown in FIG. **3**) is threadedly engaged to upper clutch element **48** which has dog clutch lugs **50** on the lower end. Also, these lugs are shown in FIG. **1**. Jay-pin housing **24** has cooperating dog clutch lugs **52** also shown in FIG. **1**. Sleeve **54** has a flange **56** which is engageable with a cooperating flange **58** in clutch element **48**. Sleeve **54** is slidable vertically inside jay-pin housing **24**. Jay-pin housing **24** is urged upwardly with respect to sleeve **54** by spring **60** which engages jay-pin housing **24** and retaining nut **62** which is threadedly engaged to sleeve **54** with threads **64**.

Briefly to review, the setting of the packer requires the following manipulation of the tubing: (1) the tubing is lowered to a greater depth than the desired setting depth for the packer; (2) the tubing is lifted so the packer is positioned at the desired setting depth; (3) the tubing is rotated to the right to align the long leg of the jay-slot with jay-pin **18** so the tubing may be lowered, leaving the jay-pin housing **24** and the associated housing **22** and lower gripping elements **30** held in position by friction pad **20** engaging the casing. As the tubing is lowered, the lower slips **30** grip the casing and the packer is set. The tubing and the jay-slot travel downwardly far enough to position the jay-slot **16** so that jay-pin **18** is in position **18*c*** shown in FIG. **2**. The tubing continues downwardly and contact of jay-slot **16** with jay-pin **18** to push jay-pin **18** downward, moves jay-pin housing **24** downward and disengages clutch lugs **50** and **52**. Jay-pin housing **24** then rotates to align jay-pin **18** with circle **18e** in jay-slot **16** as shown in FIG. **2**.

Therefore, with the improved latch including a clutch according to this invention, the packer may be set by picking up the tubing string at the surface, rotating to the right until ¼ turn of the jay-slot in the well tool is accomplished and setting down the tubing at the surface. Residual right-hand torque in the tubing will "spin out" at the clutch in the packer because engagement of the jay-pin against jay-slot at **18*c*** will compress spring **60** and disengage lugs **50** and **52**, allowing the tubing and jay-slot to rotate freely, relieve residual torque in the tubing at the packer, and allow jay-pin **18** to rotate into axial alignment with the upper portion of the jay-slot **16** and move to position **18*e***.

When it is desired to release the well tool from the well, upstrain may be pulled at the surface on the tubing to pull surface **19** of jay-slot **16** into engagement with jay-pin **18** as shown in FIG. **2** at position **18*d***.

Referring now to FIG. **3**, shoulder **19** is shown in engagement with jay-pin **18** and thus illustrates clutch lugs **50** and **52** in engaging po0ition. Right-hand torque may then be imposed on the tubing to rotate jay-slot **16** to the right moving the jay-pin toward position **18*c***. If clutch lugs **50** and **52** are not in proper alignment to matingly engage upon application of upstrain to jay-slot **16**, right-hand rotation of the tubing combined with upstrain will cause lugs **52** to rotate into engaging position. Then relative rotation between jay-slot **16** and jay-pin **18** can be accomplished. Once the jay-slot **16** is moved so that jay-pin **18** is relatively in position **18*c*** illustrated in FIG. **2**, upstrain on the tubing causes release of the well tool whereupon the tool may be withdrawn from the well.

Location of the clutch to operably connect and disconnect the tubing including the packer mandrel from the friction means illustrated by friction pads **20** allows the tubing at the packer to rotate and relieve residual torque. It is important to disconnect the tubing from rotational engagement with the friction means; otherwise torque sufficient to rotate the friction means inside the casing could be residual in the tubing. It is desirable to expend such residual torque for reasons hereinbefore stated.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An improved well tool that will allow twist in a tubing to be relieved, said improved well tool connectable to tubing and adapted to be set in casing, said improved well tool having a mandrel, a well tool support means for gripping the casing, a releasable connection between the mandrel and support means, and friction means for frictionally engaging the well tool to the casing, the improvement comprising a clutch means operably connecting the releasable connection to the friction means for selectively disengaging the releasable connection from the friction means and allowing twist in said tubing to be relieved.

2. The well tool of claim **1** wherein the releasable connection comprises:

a jay-slot; and

a jay-pin cooperative with said jay-slot.

3. The well tool of claim **2** wherein:

the clutch is engaged in a first position; and

the clutch is disengaged in a second position.

4. The well tool of claim **3** wherein the clutch is operably connected with the tubing to move the clutch between said first position and said second position.

5. The well tool of claim **3** wherein said clutch comprises:

a first member having at least one lug; and

a second member drivingly engageable with the first member.

6. The well tool of claim **5** wherein resilient means urge the first member and the second member of the clutch into said first position.

7. Well packer apparatus connectable to tubing and adapted to be set in casing, said well packer apparatus adapted to relieve twist in said tubing, comprising:

a mandrel;

a packing structure encircling said mandrel;

gripping means for supporting said packing structure;

releasable means connecting said mandrel to said gripping means to allow selective operation of said gripping means;

frictional means for frictionally engaging the apparatus to the casing; and

selectively operable clutch connecting said releasable means to said friction means for selectively disengaging said mandrel and said friction means and allowing twist in said tubing to be relieved.

8. An apparatus connectable to well tubing and adapted to be anchored in a well casing disposed in a well bore, said apparatus adapted to relieve twist in said tubing, comprising:

a body;

a tubular mandrel within said body;

means for anchoring said body to the well casing against downward movement;

control means releasably connecting said mandrel to said anchoring means;

frictional means for frictionally engaging the apparatus to the casing; and

a clutch for selectively engaging and disengaging said control means and said friction means thereby.

9. The apparatus according to claim **8** having sealing means on said body adapted to seal against the well casing and said sealing means is adapted to be supported by said anchoring means.

10. The apparatus of claim **8** wherein the control means comprises:

a jay-slot; and

a jay-pin cooperative with said jay-slot.

11. The apparatus of claim **8** wherein:

the clutch means is engaged in a first position; and

the clutch means is disengaged in a second position.

12. The apparatus of claim **11** wherein the clutch means is operably connected with the tubing to move the clutch between said first position and said second position.

13. The apparatus of claim **11** wherein said clutch means comprises:

a first member having at least one lug; and

a second member drivingly engageable with the first member.

14. The well tool of claim **13** wherein resilient means urge the first member and the second member of the clutch means into said first position.

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