United States Patent

[11] **3,556,216**

[72] Inventor **Elmo L. Condra**
17791 Santa Gertrude's Circle, Fountain Valley, Calif. 90630

[21] Appl. No. **875,044**
[22] Filed **Nov. 10, 1969**
[45] Patented **Jan. 19, 1971**

[54] **DEEP WELL PUMP ANCHOR**
3 Claims, 8 Drawing Figs.

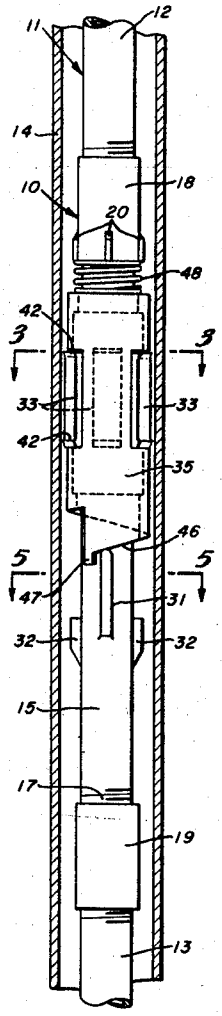
[52] **U.S. Cl.** **166/215,** 166/217
[51] **Int. Cl.** **E21b 23/00**
[50] **Field of Search** 166/216, 217, 215

[56] **References Cited**
UNITED STATES PATENTS

2,442,121	5/1948	Earley	166/216
2,953,406	9/1960	Young	166/217
3,294,173	12/1966	Hodges	166/217

Primary Examiner—James A. Leppink
Attorney—Dana E. Keech

ABSTRACT: A hollow mandrel connected in a pump tubing string above or below the pump, conical cams formed externally in said mandrel expanding wickered slips slot mounted in a tubular sleeve surrounding said mandrel which sleeve is spring biased downwardly to cause expansion of said slips when said sleeve is rotated clockwise by pump vibration and by gravity action produced by steep helical track on sleeve resting on fixed lug on mandrel. Setting of slips thus anchors pump in casing. Release of slips is effected by lifting of slip mounting sleeve relative to mandrel by action of mandrel lug on helical track when pump tubing is rotated clockwise in preparation for withdrawing pump from well.



PATENTED JAN 19 1971

3,556,216

SHEET 1 OF 2

FIG_1_

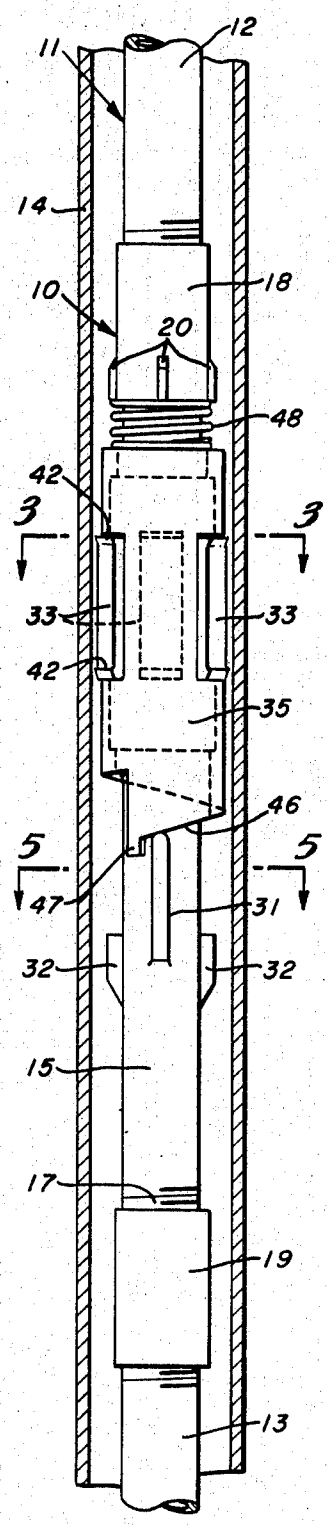


FIG_2_

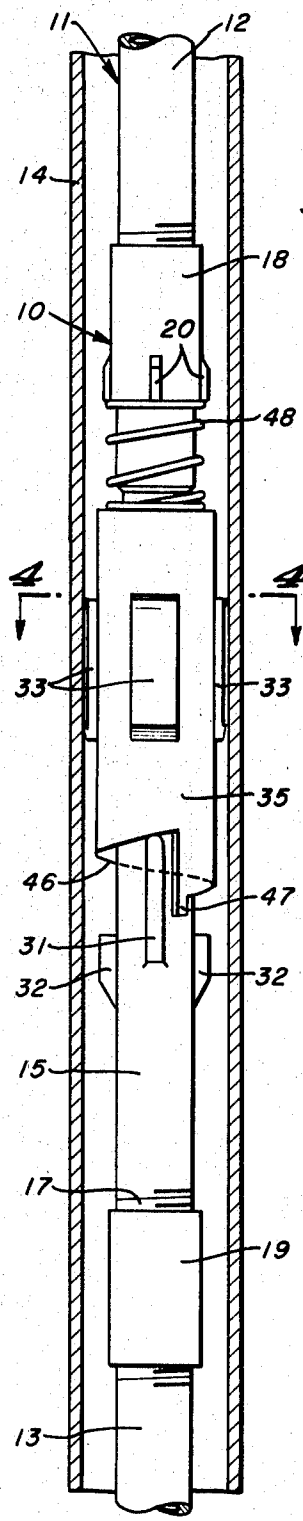


FIG_3_

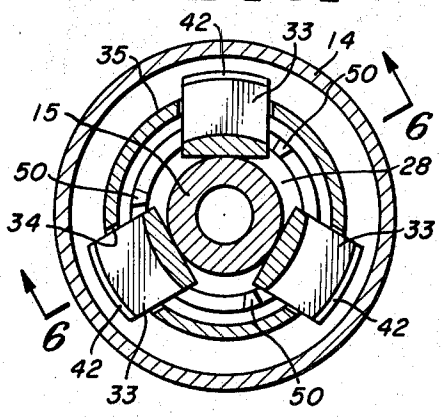


FIG_4_

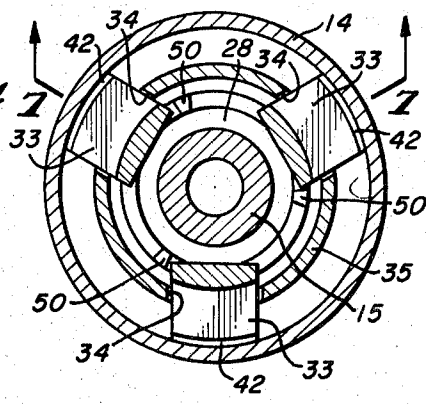
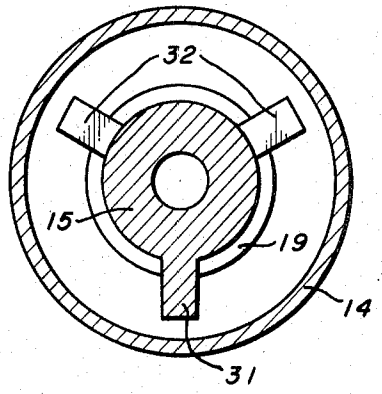


FIG_5_



INVENTOR.
ELMO L. CONDRA

BY

ATTORNEY.

FIG_6_

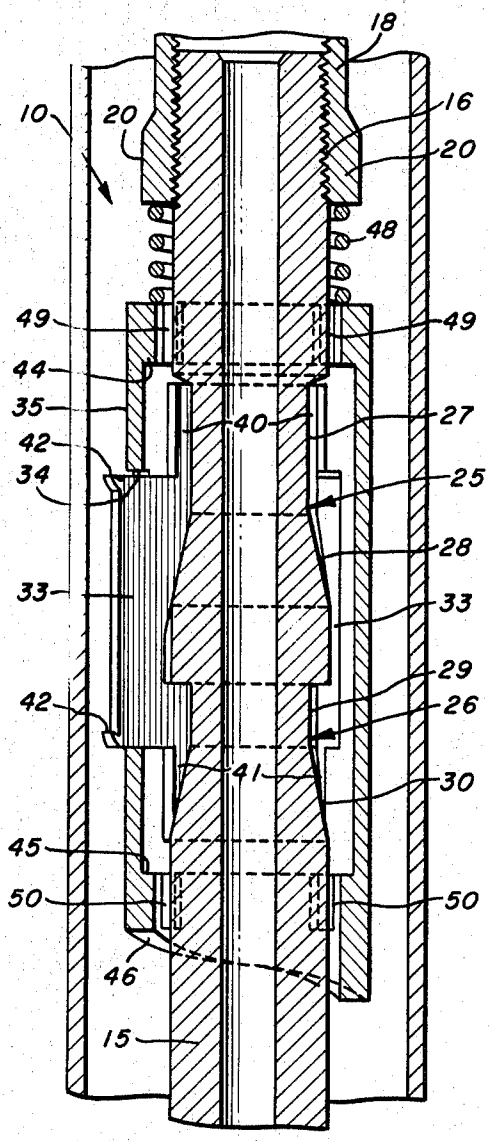


FIG_7_

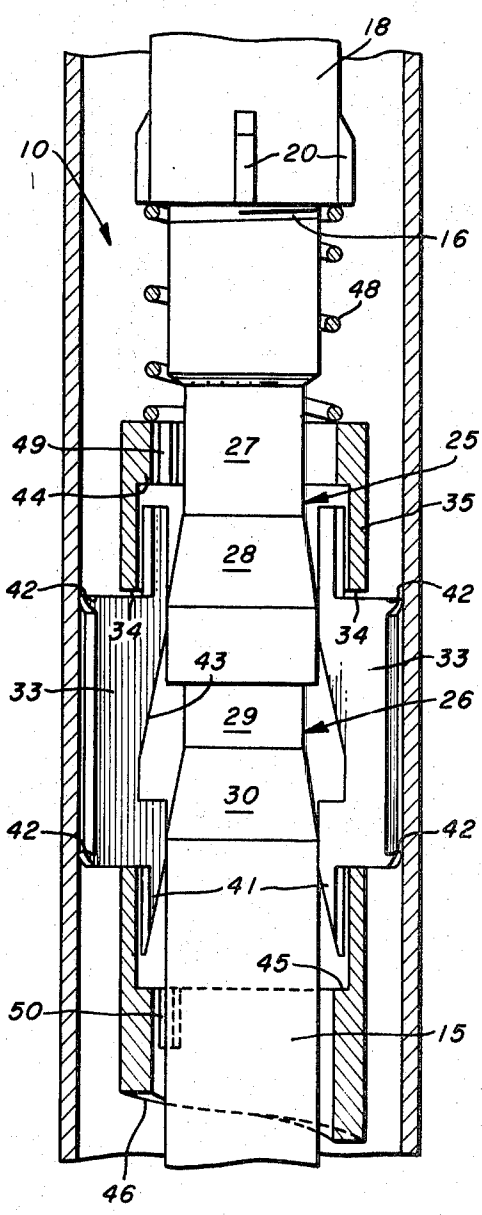
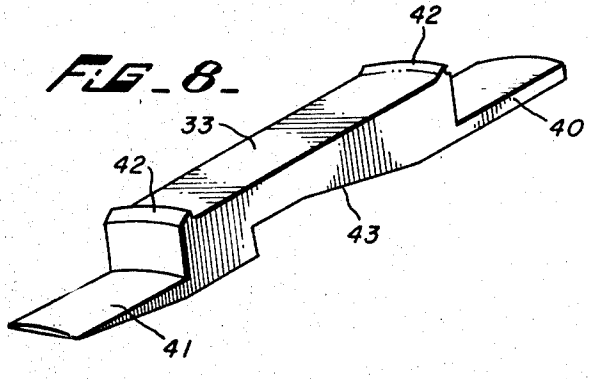


FIG_8_



INVENTOR.
ELMO L. CONDRA

BY.

ATTORNEY.

DEEP WELL PUMP ANCHOR

SUMMARY OF INVENTION

Faulty operation occurs in deep well sucker rod actuated pumps when the pump is free to creep upward during the upstroke of the pump.

It is therefore a principal object of the present invention to provide a deep well pump anchor which can be inserted in a string of pump tubing close to the pump and preferably therebelow and which will anchor the pump in a fixed position in the well casing throughout a normal season of pumping and may then be readily deactivated to facilitate removal of the pump for servicing.

Another object of the invention is to provide such an anchor which may be readily inserted with the pump into the well in a retracted condition facilitating such insertion and which will then react to the vibration produced by starting to pump the well so as to set the anchor in the surrounding casing thereby anchoring the pump as positioned.

A further object is to provide such an anchor as may be deactivated at will merely by clockwise rotation of the string of pump tubing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical sectional view of a well casing enclosing a string of pump tubing including a preferred embodiment of the present invention with the slips thereof retracted.

FIG. 2 is a view similar to FIG. 1 with the slips expanded.

FIG. 3 is a horizontal sectional view taken on the line 3–3 of FIG. 1.

FIG. 4 is a horizontal sectional view taken on the line 4–4 of FIG. 2.

FIG. 5 is a horizontal sectional view taken on the line 5–5 of FIG. 1.

FIG. 6 is a vertical sectional view taken on the line 6–6 of FIG. 3.

FIG. 7 is a vertical sectional view taken on the line 7–7 of FIG. 4.

FIG. 8 is a perspective view of a slip of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment of the invention illustrated in the drawings comprises a deep well pump anchor **10** which is adapted to be assembled sequentially in a pump tubing string **11** by connecting upper and lower ends of the anchor **10** respectively to adjacent tubing sections **12** and **13**. A deep well pump (not shown) is also incorporated in the pump tubing string **11** preferably just below or just above the anchor **10**. The anchor **10** is employed thus associated with a deep well pump in a pump tubing string to anchor the pump at a preselected level in a deep well which is lined with a well casing **14** and which is engaged by the anchor **10** to accomplish its anchoring function.

The anchor **10** includes a hollow steel mandrel **15** having external threads **16** and **17** adjacent its upper and lower ends to receive couplings **18** and **19** by which the mandrel **15** is connected to pump tubing sections **12** and **13**. The coupling **18** is provided externally adjacent its lower end with a series of four vertical ribs **20**, the purpose of which will be made clear hereinafter.

The mandrel **15** is provided exteriorly with consecutive shallow annular recesses **25** and **26**, the upper recess **25** having an upper cylindrical surface **27** and below this an upwardly tapering conical cam face **28**. The lower annular recess **26** has a cylindrical surface **29**, and, therebelow, an upwardly tapering conical cam face **30**. The cylindrical surfaces **27** and **29** have like diameters and the conical cam faces **28** and **30** are tapered alike. Apart from recesses **25** and **26**, the mandrel **15** is cylindrical with a uniform diameter throughout its length. Welded to the outer surface of the mandrel **15** in an area approximately midway between the lower end of lower annular recess **26** and the bottom end of the mandrel is a sleeve supporting lug **31** and a pair of shorter spacing lugs **32**, these three lugs being equally spaced circumferentially about the mandrel.

The anchor **10** also includes three slips **33**, one of which is shown in FIG. **8**, which fit slideably within three vertical slots **34** which are provided in a slip mounting sleeve **35** and on the same level therein and equally spaced circumferentially in said sleeve. Thin plates **40** and **41** extend upwardly and downwardly respectively from the upper and lower ends of the slips **33** and are formed integral with the body of the slip. The outer surfaces of the slips **33** have an arched conformation the purpose of which will be made clear hereinafter. Each slip is provided at its upper and lower radially outermost edges with arcuate wickers **42** the cutting edges of which face upwardly. The radially inner face **43** of each slip **33** is shaped to conform to the annular mandrel recesses **25** and **26** when this slip is in its retracted position as shown in FIG. **6**. This occurs when the sleeve **35** is in its uppermost position as shown in this view, and this is effected in the following manner.

Formed inwardly in an upper end portion of the sleeve **35** is an annular reinforcing shoulder **44** which decreases the internal diameter of this portion of said sleeve. Also formed inwardly from a lower end portion of sleeve **35** is an axially longer annular internal shoulder **45** and the lower end of the sleeve **35**, where it is reinforced by shoulder **45**, has a fairly steeply inclined helical track **46** provided thereon which terminates at its lower end in a stop shoulder **47**.

Coiled about the mandrel **15** between the coupling **18** and the upper end of sleeve **35** is an expansive spring **48**. The sleeve **35** rests downwardly by its own weight upon the supporting lug **31** and the level at which the sleeve is thus supported depends upon the point in the helical track **46** at which said sleeve rests upon said lug. The sleeve is completely free to rotate about the mandrel **15** between an upper position which is approximately shown in FIG. **1** where the stop shoulder **47** engages the left side of the sleeve supporting lug **31** and its downward position which is approximately shown in FIG. **2**, where said shoulder engages the right side of said lug. The anchor **10** is assembled with coil spring **48** under such an expansive tension that the sleeve **35**, however positioned, is always spring biased downwardly.

To assist in maintaining the slip mounting sleeve **35** in concentric relation with the mandrel **15**, the upper annular internal shoulder **44** is provided with three guide ribs **49** and the lower annular internal shoulder **45** is provided with three similar guide ribs **50** which ribs slideably contact the mandrel **15** in areas of its maximum outside diameter, at least while the anchor is in retracted condition, as shown in !FIG. **6**, which is the only time that this assistance at both ends of the sleeve **35** is required, as will be pointed out in explaining the operation of the invention.

OPERATION

When the sleeve **35** is rotated as shown in FIG. **1** with the stop shoulder **47** almost contacting the left side of lug **31**, the sleeve **35** is supported in approximately its uppermost position on the mandrel **15** which, in turn, supports the three slips **33** in their uppermost positions as shown in FIG. **6** where it is seen that the inner surfaces **43** of the slips conform to the shape given the outer surface of the mandrel **15** by the annular external recesses **25** and **26**. This permits the slips **33** to yield to any pressure from the outside so as to withdraw to their fully retracted position shown in this view. It is with the tool **10** in this position that the tubing string **11** embodying the anchor **10** and a deep well pump (not shown), is lowered into the well. When the installation of the tubing string **11** has proceeded to the point where the pump is located at the proper level for conducting deep well pumping operations the lowering of the pump tubing string **11** is halted and the necessary steps taken for placing the pump in operation. The reciprocation of the plunger in the pump through a sucker rod extending to the surface of the well, produces a vibration in the anchor **10** which, added to the downward pressure exerted on the sleeve

35 by its own weight and the weight of slips 33 as well as the constant downward bias of spring 48, produces a resultant rotational force through the caming action of the helical track 46 on the stationary lug 31, which rotates the sleeve 35 to the position in which this is shown in FIG. 2 thereby lowering the sleeve together with the slips 33 to the positions in which these are shown in FIG. 7. This shifts the three slips 33 radially outwardly through the slots 34 in the sleeve 35 and presses the wickers 42 against the inner face of well casing 14, as also shown in FIG. 4, with the result that these wickers bite into the metal of the casing and thus prevent elevation of the anchor 10 in said casing and this likewise anchors the pump in place.

As long as the anchor 10 remains settled in this position in the casing 14 it retains its gripping relation with the interior of the casing and continues to lock the pump associated therewith in a fixed location on the well. All that is necessary for this locking action of the anchor to continue in effect is to allow the anchor to remain thus expanded in the casing and it will do this until it is disturbed from this relationship with the casing by a clockwise rotation of the pump tubing string 11. Such a rotation does not take effect however unless this is done deliberately and for the express purpose of releasing the anchor from gripping relation with the casing and this is ordinarily deferred until the conclusion of a normal pumping season when it becomes necessary to remove the pump tubing string from the well for purposes of conducting the seasonal inspection and repairs of the pump before reintroducing the same for another season's operation.

Rotation of the pump tubing string 11 clockwise for the purpose of causing the anchor to release its grip on the casing, rotates the mandrel 15 which causes the lug 31 to travel about the lower end of the mandrel in contact with the helical track 46 which has the effect of lifting the sleeve 35 from its lower-

most position shown in FIGS. 2 and 7 to its uppermost position shown in FIGS. 1 and 6. As shown in these views, the lifting of the sleeve 35 lifts the slips 33 to a level where these are opposite the annular recesses formed exteriorly in the mandrel and into which the slips 33 are free to move. This freedom inevitably breaks the hold which the wickers have taken on the inner surface of the well casing and frees the anchor and the pump and the pump tubing string 11 for ready withdrawal from the well.

I claim:

1. A device for anchoring a deep well pump in a surrounding casing, said device comprising:

a hollow mandrel having means at its upper end to suspend it from a pumping string;

conical cam means exteriorly provided on said mandrel and tapering upwardly;

wickered slips fitting said cam means and adapted to be expanded by downward movement of said slips;

a sleeve surrounding said mandrel and having slots in which said slips are mounted, there being a helical track provided on the lower end of said sleeve;

a lug projecting from said mandrel into supporting relation with said sleeve so that said track rests on said lug; and

spring means biasing said sleeve downwardly on said mandrel.

2. A device as recited in claim 1 wherein stop means is provided for limiting the degree of relative rotation permitted between said mandrel and said sleeve to the length of said helical track.

3. A device as recited in claim 2 wherein said track is relatively steeply angled and is approximately 350° in length.