

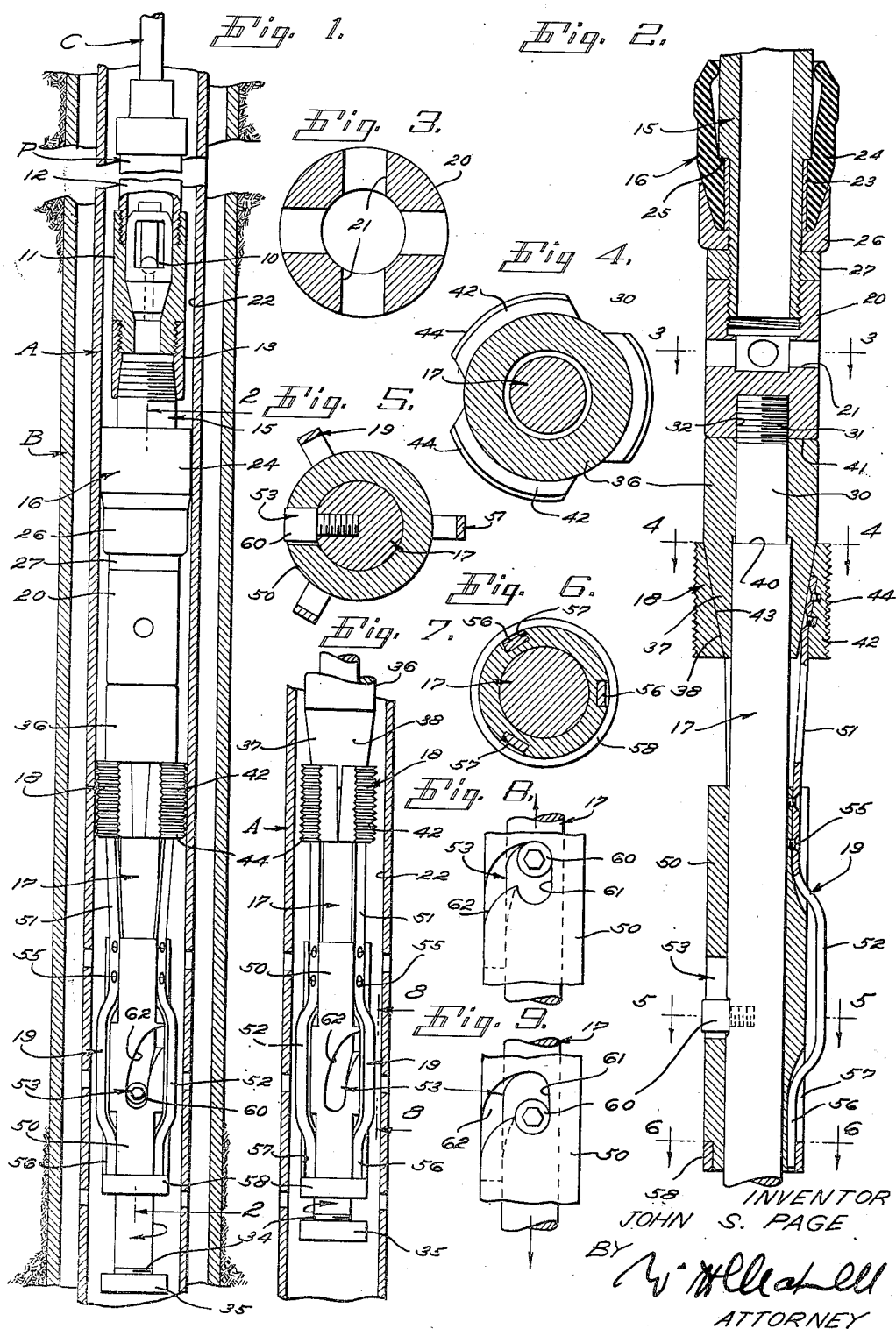
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PUMP ANCHOR

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PUMP ANCHOR

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This invention has to do with a pump anchor, that is with a device applicable to a well pump and engageable in a tubing, or the like, to secure or anchor the pump therein, and it is a general object of the invention to provide such a structure which is simple, practical and inexpensive.

It is most common to operate well pumps within tubing and the ordinary pump cooperates with a pump seat or pump holder set or fixed in the tubing at a particular point, with the result that the location of the pump in the well cannot be varied except by pulling the tubing and relocating the seat or retainer.

It is a general object of the present invention to provide a pump anchor that may be used on or in connection with conventional pumping equipment and which engages a tubing in a manner to effectively secure or anchor the pump while it is at the same time releasable so that it can be shifted to various positions in the tubing should it be desired to vary the location of the pump in the tubing.

Another general object of the present invention is to provide a structure of the general character referred to wherein the parts are so related as to function effectively and dependably and without danger of becoming stuck or fouled, even after the anchor has been engaged in a tubing over a long period of time. With the construction of the present invention the gripper that sets the anchor in the tubing is mounted on the body of the anchor so that it is freely rotatable and the gripping members or slips of the gripper are freely shiftable relative to the wedge of the gripper, all with the result that fouling or binding of the mechanism is eliminated.

Another object of the present invention is to provide an anchor of the general character referred to wherein there is a control for the gripper, which control operates effectively and dependably in response to manipulation of the apparatus through or by means of the sucker rod provided for operating the pump.

It is a further object of the present invention to provide a pump anchor operating to secure a pump in a tubing without requiring that the tubing be equipped with a pump seat or pump holder, as is the case with ordinary equipment.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view of a portion of a well showing a pump located therein

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and an anchor embodying the present invention on the pump securing the pump in a tubing, certain of the parts being shown in section and the anchor being shown set, holding the pump in position in the tubing. Fig. 2 is a longitudinal sectional view of the anchor provided by the present invention showing it independent of other parts, that is, not within a tubing, and showing the packer in its normal or unactuated condition, and showing the gripper in an actuated position. Fig. 3 is an enlarged detailed transverse sectional view taken as indicated by line 3—3 on Fig. 2. Fig. 4 is an enlarged detailed transverse sectional view taken as indicated by line 4—4 on Fig. 2. Fig. 5 is an enlarged detailed sectional view taken as indicated by line 5—5 on Fig. 2. Fig. 6 is an enlarged, detailed transverse sectional view taken as indicated by line 6—6 on Fig. 2. Fig. 7 is a view similar to a portion of Fig. 1, showing the anchor within the tubing and in a released position. Fig. 8 is an enlarged view of a part of the mechanism shown in Fig. 7, taken in the direction indicated by line 8—8 on Fig. 7, and showing the control in a partially actuated position, and Fig. 9 is a view similar to Fig. 8, showing the parts in the position in which they occur as the anchor is being lowered into or through the tubing.

The structure provided by the present invention is intended to be operated in a well equipped with a tubing A, or the like, and more specifically the anchor of the present invention is applicable to a well pump P to be joined with the pump so that it depends therefrom. In the drawings the tubing A is shown in a well within a well casing B and the pump P is shown carried on or by a sucker rod C. When I use the term "tubing" I mean to include any tubular well element with which the structure that I am about to describe will cooperate.

The pump P may, so far as this invention is concerned, be of any suitable form or construction. The particular pump illustrated is shown as including a foot valve 10 carried in a holder or seat 11 at the lower end of a tubular body 12. The sucker rod C enters the pump from its upper end and in the course of normal operation of the pump the pump part or parts joined to the sucker rod are reciprocated by or with the rod while other portions of the pump are held stationary. In the case illustrated the valve holder 11 is held stationary and in turn holds the other stationary parts of the pump, the anchor of the present invention being employed to hold the pump part 11 as will be apparent from the drawings.

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The anchor provided by the present invention is preferably located in the tubing A immediately below the pump P and may, as shown in the drawings, be joined to the pump by a suitable coupling 13 so that it is immediately adjacent the pump. The anchor is such as to engage the interior of the tubing A and when set holds the pump in a fixed position in the tubing, but it is operable or releasable so that the pump with the anchor attached thereto may be moved to any desired position in the tubing.

The anchor embodying the present invention involves, generally, a flow tube 15 admitting fluid from the well or from the tubing to the pump, a packer 16 sealing with the tubing A and preferably between the flow tube 15 and the tubing, a body 17 which is an elongate part depending from the flow tubing 15, a gripper or gripping mechanism 18 carried by the body 17 and operable to engage the tubing A, and a control 19 for the gripping mechanism.

The flow tube 15 is an elongate tubular part located centrally in the tubing A or so that it is concentric with the pump P and it may be joined to the lower end of the pump P in any suitable manner. In the case illustrated the coupler 13 is shown threaded to the upper end of the flow tube 15 and thus directly connects the flow tube or anchor with the pump so that the flow tube is in direct communication with the pump through the element 11 of the pump.

The flow tube 15, as shown in the drawings, is sectional or is formed with a head section 20 at its lower end which serves as a closure for the lower end of the flow tube and which has lateral ports 21 that form inlet openings admitting fluid from within the tubing to the flow tube 15 to flow upwardly therethrough and into the pump. In the case illustrated the head 20 is screw threaded onto the lower end of the tubular portion of the flow tube 15.

The packer 16 is an annular element or structure, preferably carried on the flow tube 15 to have sealing engagement with the inner wall 22 of the tubing A. The particular packer illustrated is a common or simple form of packer involving a sleeve 23 carrying an annular body 24 of rubber, or the like, which body has an upwardly and outwardly projecting lip portion shaped and proportioned to normally bear outwardly against the inner wall 22 of the tubing. The lip portion of the packer is faced upwardly so that the column of fluid that may occur in the tubing A above the packer tends to expand the packer and consequently hold it in sealing engagement with the tubing.

The packer 16 may in practice be mounted in any suitable manner so long as it is sealed with or tight on the flow tube and has the desired sealing engagement with the interior of the tubing A. In the case illustrated the sleeve 23 of the packer is confined or held between a downwardly facing shoulder 25 on the flow tube 15 and a retainer 26 engaged on the lower end portion of the flow tube and held by a clamp nut 27. The clamp nut 27 is threaded on the flow tube and secures the retainer 26 in place so the sleeve 23 is firmly clamped or held between the retainer and the shoulder 25.

The body 17 is an elongate centrally disposed member and is preferably in the nature of a rod joined to the lower end of the flow tube or to the head on the flow tube and depending therefrom to carry the grip mechanism and the control 19. In the drawings the body is shown as

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a simple round rod with a reduced upper end portion 30 with its upper end 31 threaded and engaged in a socket 32 in the lower end of the head 20 of the flow tube. In the particular case illustrated the lower end 34 of the body 17 that occurs below the control 19 is threaded and may carry a stop 35 positively preventing displacement of parts from the body, or it may receive other parts or equipment desired to be connected to the lower end of the anchor.

The gripping mechanism 18 involves, generally, a wedge carried by the body 17 and slips cooperating with the wedge. In the particular case illustrated the wedge of mechanism 18 has a collar portion 36 rotatably supported on the upper end portion 30 of the body 17 and it has a lower or depending wedge portion 37 that is downwardly convergent or tapered to present a conical wedge face 38. The collar portion 36 is confined against axial movement between the shoulder 40 where the end portion 30 of the body begins and the lower end 41 of the head 20. The wedge portion 37 of the wedge surrounds and is freely rotatable on the body 17 immediately below the upper end portion 30 thereof.

The slips 42 of the grip mechanism engage and cooperate with the wedge portion 37 of the wedge member. In the case illustrated there are several like slips 42 circumferentially spaced on wedge portion 37. The slips have inner faces 43 that bear upon the wedge face 38 and the slips are free to move around and also longitudinally of the wedge portion 37. The outer faces of the slips may be provided with teeth 44 or may be otherwise finished to have the desired gripping engagement with the interior of the tubing A when the mechanism is set.

With the construction above described the slips may be retracted or free of tubing A when down relative to the wedge portion 37, as shown in Fig. 7, and they are expanded and held out in gripping engagement with the casing A when they are in an up position relative to the wedge portion 37, as shown in Figs. 1 and 2 of the drawings.

The control 19 is located on the body 17 below the mechanism just described and in its preferred form it involves, generally, a sleeve 50 operable on the body, spring arms 51 extending upwardly from the sleeve and carrying the slips 42, drag members 52 connected with the sleeve and engaging the interior of casing A to offer resistance to movement of the anchor in the tubing, and a coupling means 53 between the sleeve and the body governing or guiding movement of the sleeve relative to the body.

The sleeve 50 is an elongate tubular part fitted on the body 17 to be freely rotatable thereon and also movable longitudinally thereon.

The spring arms 51 are preferably anchored to or joined with the upper end portion of sleeve 50 and project upwardly therefrom to carry the slips 42, it being preferred that there be one arm for each slip and that the slips be supported uniformly above the sleeve 50 so that they operate uniformly on the wedge portion 37 and thus have uniform gripping action in or with the casing A. The arms 51 are of such length and are sufficiently flexible as to allow the slips to be properly expanded under the influence of the wedge member while at the same time they effectively withdraw or retract the slips moving them to a collapsed position such as is shown in Fig. 7 when the wedge portion 37 is disengaged from within the slips.

The drag members 52 are preferably leaf or bow

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springs with their ends bearing on the sleeve 50 and with their outer or bowed portions such as to normally bear in the tubing A. In the case illustrated the upper end portions of the drag members 52 are fixed or anchored to the sleeve 50 as by suitable fasteners 55, while the lower end portions 56 of the members 52 slidably bear on the sleeve being engaged in guideways 57 in the sleeve where they are confined by a collar 58. In the particular case illustrated the drag members 52 correspond in number and circumferential location with the arms 51, and they are integrally joined with the arms 51. When this construction is employed one single continuous length of suitable spring material or spring steel may be employed in forming the arms 51 and the members 52.

The coupling 53 provided between the body 17 and the sleeve 50 involves a lug or projection 60 on the body 17 operating in an opening or guideway in the sleeve 50. In accordance with my invention the guideway has a short vertical portion 61 extending lengthwise of the structure and has a long helical portion 62 joining one side of the vertical portion 61 at the upper end thereof and extending down and around in the sleeve from the point where it joins the portion 61. The projection 60 fits the guideway to be movable through the portions 61 and 62 thereof.

When the anchor is being lowered in the tubing A the drag members 52 make it necessary that the sleeve 50 be forced downwardly by the lowering of the sucker rod and the pump attached thereto. When the sucker rod and pump are lowered the body 17 of the anchor is lowered and the projection 60 engages in the lower end of the vertical guideway portion 61 as shown in Fig. 9 of the drawings. When the projection 60 is engaged in the lower end of guideway portion 61 the sleeve 50 is in a down position on the body 17 holding the slips 40 down relative to the wedge portion 37.

When it is desired to set the slips the operator lifts upwardly on the sucker rod C lifting the pump P and the body 17 to move projection 60 to the upper end of portion 61 of the guideway, following which the sucker rod is rotated to turn the projection 60 into the helical portion 62 of the guideway. As the projection 60 enters or moves into the portion 62 of the guideway from the portion 61 thereof relative movement occurs between the sleeve 50 and the body 17 in a direction lengthwise of the anchor causing the sleeve to move the slips 40 upwardly onto the wedge portion 37 so that the slips are, in turn, moved outwardly into gripping engagement with the tubing A.

With the slips set or engaged in the tubing A the anchor is set and the pump is held in position in the tubing A to be operated by means of the sucker rod C in the conventional manner.

When it is desired to release the anchor either to withdraw the entire structure from the tubing or to shift the position of the pump either up or down in the tubing, it is merely necessary for the operator to move the sucker rod up far enough to cause the projection 60 on the anchor body 17 to move up through the helical guideway portion 62 into the upper end of the vertical guideway portion 61, in which position of the parts the slips 42 are disengaged from the wedge portion 37 so that the slips are released from the tubing A. If the entire structure is to be moved up the projection 60 will continue in the upper end part of the guideway portion 61 whereas if

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the structure is to be moved down the sucker rod is lowered, allowing the projection 60 to move into the lower part of guideway portion 61, as shown in Fig. 9.

During the upward movement of the sucker rod causing the body 17 to move up relative to the sleeve and the projection 60 to be moved up in the guideway portion 62, it is unnecessary for the operator to rotate the sucker rod as the cam action occurring between the projection 60 and the guideway portion 62 is such as to rotate the sleeve 50 on the body 17 against the resistance of the drag members 52.

From the foregoing description it will be apparent that I have, by my present invention, provided a pump anchor which is secure and dependable in holding a pump in position so that it may be operated in the conventional manner by means of a sucker rod, while at the same time the anchor is releasable whenever desired, so that the pump can be moved either up or down in the tubing A enabling it to be placed in a most advantageous position in the well. It is also most significant to note that through my present invention the grip or gripping mechanism that sets the anchor in the tubing is not only simple and involves few parts, but these parts are free to accommodate themselves relative to each other and are freely rotatable relative to the body of the anchor, all with the result that the anchor works freely and the danger of the parts becoming stuck or fouled is minimized.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and fall within the scope of the following claims:

Having described my invention, I claim:

1. A structure for anchoring a pump in a well tubing including, a flow tube applicable to the pump to depend therefrom and having lateral openings passing fluid from the tubing into the flow tube, a rod attached to the flow tube and depending in the tubing forming an elongate body below the flow tube, a tubing gripping mechanism on the body including a wedge collar rotatable on the body and slips operating on the collar, and a control for said mechanism and on the body including, a sleeve slidable on the body and having a longitudinally disposed cam slot therein, drag springs on the sleeve engaging the tubing, spring arms projecting upwardly from the sleeve and carrying the slips, and a projection on the body operating in the slot in the sleeve, the arms being integral continuations of the drag springs.

2. An anchor for securing a pump in a well tubing including, a flow tube applicable to the pump and having a head capping its lower end, the head having lateral inlet ports in connection with the flow tube and a downwardly opening socket, an upwardly faced cup-shaped packer on the flow tube above the parts and supported by the head, an elongate central body engaged in the socket to depend from the head and within the tubing and having a reduced upper end portion, a wedge collar rotatable on the reduced portion of the body and confined thereon by the head, slips operable on the collar lengthwise thereof and also around the collar, a sleeve slidable on the body and below the collar and having a cam slot therein and also having circumferentially spaced longitudinally disposed guideways

therein, spring arms projecting from the sleeve and carrying the slips, drag springs on the sleeve with outwardly bowed middle portions engaging the tubing, each drag spring having a lower end portion slidably engaged in a guideway in the sleeve, and a projection on the body operating in the cam slot in the sleeve, the cam slot having a straight vertical portion and a curved portion joined to one side of the vertical portion at the upper end thereof and extending laterally and downward therefrom.

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