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WELL TOOL MOUNTING

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Fig. 1

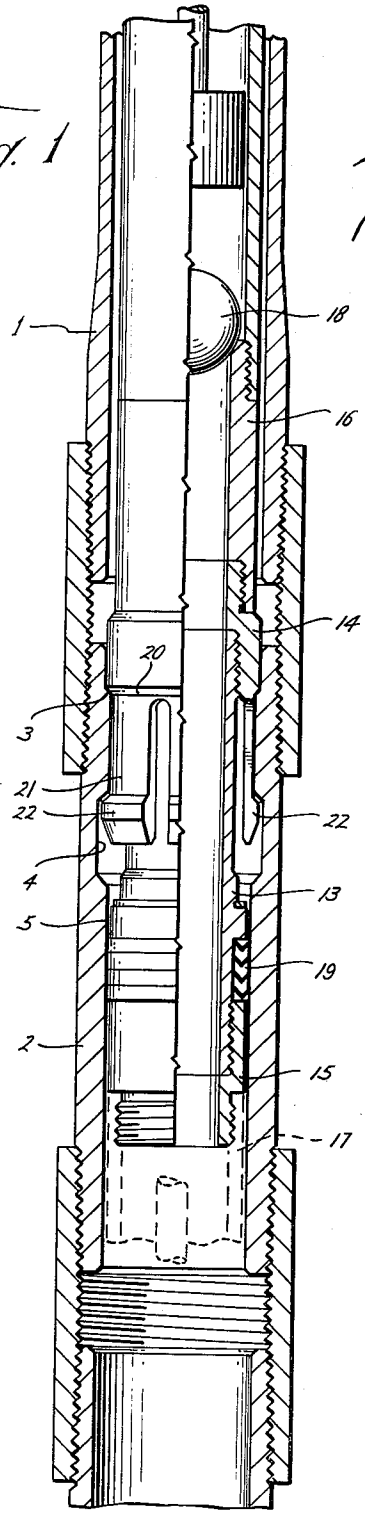
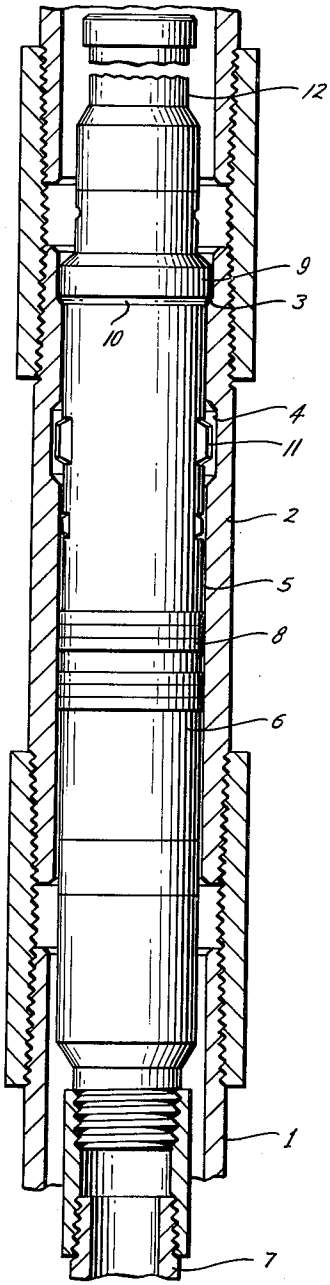


Fig. 2



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WELL TOOL MOUNTING

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This invention relates to well tools and more particularly to an improved mounting combination for the removable attachment of well working tools in a fluid production conduit.

It is an object of the invention to provide for the location at a selected depth in a well string of a landing nipple for the securement interchangeably and at different times of various equipments for the performance of work, inclusive of remedial workover operations and of the usual pumping of well fluids.

A further object of the invention is to eliminate the need and objectionable costs for incorporation in a tubing string of several distinctly different types of tool receiving devices and the need for tool anchoring devices each to match and fit a single one of the several types of tool receiving devices, and to provide for the use of a standard tool hanger receiving nipple positioned within the tubing string and adapted for co-operation with any of several different types of hangers, each arranged to have stop abutment and latch engagement with the nipple and additionally an annular sealing fit to an accurately machined internal surface below and out of the travel range of hanger latches so as to remain free of abrasion, scuffing and galling damage to the carefully finished sealing face.

Another object of the invention is to provide a tubing string having a landing nipple and a co-operating pump and hold-down of a character that the well owner can remove the pumping unit and utilize the same landing nipple for the attachment of other well working equipment, such as that usually employed for permanent completion workover and remedial operations, and thereafter replace the pumping unit for producing well fluid.

A still further object of the invention is to provide an improved pump hold-down having terminal couplings at both ends for selective attachment, either above or below the same, of a pump, and an axially extending flow opening for communicating the pump inlet with the tubing string below the hold-down when the pump is supported above the hold-down and for communicating the pump outlet with the tubing string above the hold-down when the pump is suspended below the hold-down and also having spring collet latches to make frictional seizure with the landing nipple above the nipple sealing surface whereby to save the latter from sliding engagement with and the likelihood of scoring by heavily loaded latching collets.

In the accompanying drawing, FIG. 1 is a vertical sectional view with parts in elevation showing a pump hold-down and landing nipple assembly and FIG. 2 is a similar view showing an extension tube and hanger therefor mounted in a tubing string.

The usual production or well tubing string 1 is here shown as having incorporated therein a landing nipple or tubular member 2 for location at a predetermined level of depth. This specially formed nipple 2 has a counterbored upper portion ending in an upwardly facing shoulder or annular landing seat 3. Spaced axially below the shoulder 3 and formed in the wall of the nipple is an internal annular keeper notch 4, and in the region immediately below the keeper notch the cylindrical bore is machined for an accurately dimensioned and smoothly finished face 5 for co-operation with a seal element or packer on a tool to be received within the nipple.

The seating, latching and sealing nipple as described will constitute a standard mounting device for interchangeably receiving any of several different types of tool holders selected according to the well working operation to be performed. By way of example, FIG. 2 illustrates the use of the nipple 2 for locating a conventional type of hanger, comprising a tubular housing 6 having coupled at its lower end an extension pipe 7 for suspension and projection to a predetermined depth as to extend into the region of a producing formation for the performance of a completion or conditioning job. Peripherally carried by the housing 6 are sealing or packing rings 8 which co-operate with the nipple sealing surface 5 in closing off the clearance space between the nipple and the hanger. Near its upper end, the housing 6 has an annular enlargement or head 9 whose bottom edge provides a downwardly facing shoulder or seat 10 for locating abutment with the nipple landing seat 3. In the region between the packing rings 8 and the abutment seat 10, the wall of the housing 6 is provided with several openings or windows in which are mounted laterally projectable latching dogs 11 for reception within the keeper notch 4 under control of wedging or camming bearings formed on a hollow core or plunger 12 which is slidable within the housing 6.

When the hollow core 12 is projected upwardly in the housing, the latching dogs 11 can be retracted inwardly for passage through the portion of the nipple bore between the seat 3 and the keeper notch 4. Placement and removal of the hanger and control of the latching dogs are effected through the customary wire line equipment and the axial spacing between the shoulder 10 and the dogs 11 substantially conforms to the axial spacing between the nipple seat 3 and the keeper 4, whereby during a lowering-in operation the latches 11 will become aligned with the keeper notches once the abutment seats 10 and 3 are in engagement, whereupon the plunger or core 12 can be depressed for forcing the latches outwardly into the keeper notch. Subsequent removal is effected by coupling a wire line lifting tool with the plunger 12 for first freeing the projected latches 11 for retraction and then raising the entire assembly.

A hold-down tool or hanger suitable for use with the previously described nipple and especially adapted for mounting a well producing pump, consists of an assembly shown in FIG. 1 as including a tubular element or body 13 on opposite ends of which there are threaded or otherwise joined, the terminal couplers 14 and 15 respectively. The coupling end members of the tubular body 13 are for selective connection with either the lower end of a pump unit 16 or with the upper end, depending on the height at which the pump is to be located. When the pump unit is coupled to the upper end 14, the pump inlet controlled by a check valve 18 communicates through the hollow tube 13 with the tubing string therebelow, and actuation of the pump piston raises the well fluid through the hold-down device. On the other hand, when the pump is suspended below the hold-down device, the piston rod will extend upwardly through the passage in the tube 13 and the passage will communicate the pump outlet with the tubing string above the hold-down.

In either event, the clearance around the sleeve 13 and the nipple 2 will be closed by means of a series of packing rings 19 peripherally carried by the tube 13 for bearing engagement with the polished or machine-finished bore surface 5 of the nipple. The coupler 14 at the upper end of the tube 13 is preferably of an outer diameter substantially corresponding with the diameter of the counterbored upper portion of the nipple 2 and provides an enlarged landing head having a lower shoulder or downwardly facing abutment seat 20 to engage the nipple landing seat 3 as a stop limit to relative downward travel of the hold-down assembly.

Formed integrally with and dependent axially down-

wardly from the enlarged head portion of the coupler 14 is a circular series of spring fingers 21, each of which terminates in an outwardly projected latching lug or detent 22 spaced downwardly from the seating abutment 20 a distance substantially corresponding with the axial spacing between the nipple landing seat 3 and the keeper notch 4. The outer or peripheral faces of the spring fingers or prongs 21 are shaped and dimensioned for bearing engagement with the surface of the nipple bore in the region between the landing seat 3 and the keeper notch 4, and the outwardly projecting lugs 22 when aligned with the keeper notch 4 will be received within the notch and serve as laterally retractable latching detents normally holding the hold-down assembly within the nipple.

The spring fingers 21 are formed of steel and are highly resistant to inward deflection so that forces received by the pump and hold-down during normal use in an operating installation, will be insufficient to cause inward deflection of the spring finger free ends and displacement of the latching lugs from retention within the keeper notch 4. However, deliberately directed push and pull forces applied through the pump polish rod from the surface can cause an inward camming of the latch lugs 22 during their axial passage through the nipple bore above the keeper notch. Such camming action and spring deflection are facilitated when the upper and lower edges of the lugs 22 are tapered or inclined inwardly substantially as shown in the drawing. Any wear on the nipple surface because of the frictional drag thereover of the heavily spring loaded latching projections 22, can only occur above the keeper notches 4 because of the down travel limit afforded by the landing seat 3, and the highly polished sealing surface 5 below the landing notches is never subjected to contact by the heavily loaded frictional latching projections 22 and the smooth finish of the sealing surface 5 is preserved against damage.

From the above description it will be apparent that the hold-down as supecifically described is especially adapted for mounting a pumping unit by either the upper end or the lower end thereof and for removable securement in a nipple which is also usable interchangeably with

a conventional well tool hanger device whereby there is eliminated the necessity for installing several different types of nipples each for co-operation with a different mounting device for particular jobs.

What is claimed is:

A hanger and pump assembly for use with a well tubing nipple having an internal latch keeper groove, a smoothly finished bore surface below said keeper groove and an upwardly facing landing seat above said keeper groove, said assembly including a pumping unit, a tubular hanger body connected in end to end succession with the pumping unit and provided with a well fluid passage therethrough in flow communication with said pumping unit, upper and lower coupler rings sleeved on and secured to opposite ends of the tubular body and provided with attachment means for mounting the pumping unit selectively to either coupler ring, a downwardly facing abutment seat constituted by the lower peripheral corner of the upper coupler ring to engage said landing seat, an inwardly flexible spring finger having its upper end integral with and projected downwardly from the lower corner abutment seat of said upper coupler ring and terminating at its lower end in a free tip portion positioned beside and radially outwardly spaced from said tubular body and provided outwardly thereof with a latch lug for reception within said keeper groove and an annular packer clamped by the lower coupler ring in embracing relation with said tubular body below said spring finger tip portion for sealing engagement with said smoothly finished bore surface.

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