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QUICK-CONNECT FITTING FOR OIL WELL TUBING

Filed March 31, 1961

FIG. 1.

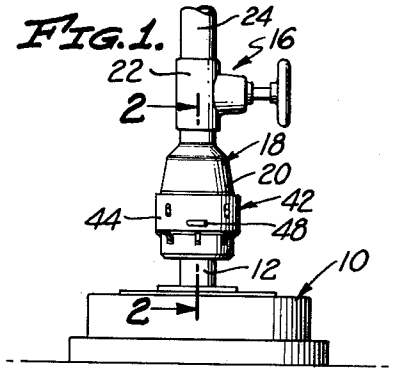


FIG. 2.

FIG. 3.

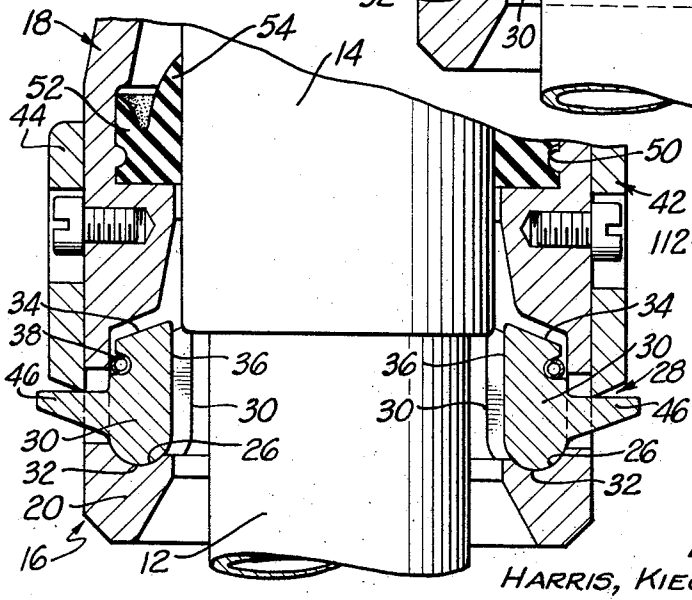
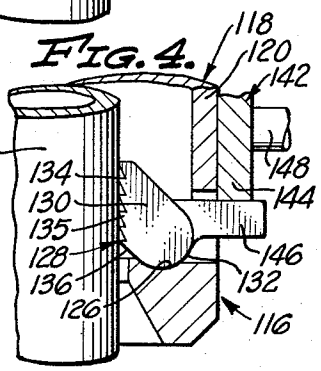


FIG. 4.



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QUICK-CONNECT FITTING FOR OIL WELL TUBING

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The present invention relates in general to shutoff valves and, more particularly, to a shutoff device which may quickly and easily be connected to the upper end of an oil well tubing string, such as a drill string, or a production tubing string, or the like, to shut off an upward flow of gas, oil, or other fluid.

When running a tubing string into or out of an oil well, sudden upward surges of fluid are frequently encountered and a primary object of the present invention is to provide a quick-connect shutoff which may merely be slipped over and latched onto the upper end of the tubing string to shut off the fluid flow under such conditions.

An important object is to provide a quick-connect shutoff which is simply engageable with the lower end of an external coupling conventionally present at the upper end of the tubing string. The ability to latch onto an external coupling in this manner is an important feature of the invention since it permits an extremely quick connection of the shutoff device to the tubing string without any necessity for providing any auxiliary means on the tubing string for engagement by the shutoff device.

Another object of the invention is to provide a shutoff device which includes latch means engageable with the lower end of the coupling at the upper end of the tubing string and adapted to be cammed outwardly into a retracted position by the coupling as the shutoff device is slipped over the upper end of the tubing string.

A further object is to provide a shutoff device having an annular seal which is engaged with the coupling at the upper end of the tubing string by the fluid pressure within the tubing string, such annular seal thus being self energizing.

Other objects of the invention are to provide a quick-connect shutoff, for an oil well tubing string having a coupling at its upper end, which includes: a tubular housing adapted to be slipped over the upper end of the tubing string and to enclose the coupling at the upper end thereof; a shutoff valve carried by the housing at the upper end thereof for shutting off flow through the housing; latch means comprising circumferentially spaced latch elements within the housing adjacent the lower end thereof and pivotable inwardly and outwardly relative thereto between inner, extended positions, wherein they are engageable with the lower end of the coupling, and outer, retracted positions, the latch elements having inner, cam surfaces engageable with the upper end of the coupling, as the housing is slipped over the upper end of the tubing string, to pivot the latch elements outwardly into their retracted positions; spring means engaging the latch elements and biasing them inwardly into their retracted positions for causing the latch elements to engage the lower end of the coupling as the housing is slipped over the upper end of the tubing string; movable retracting means carried by the housing and engageable with the latch elements for simultaneously pivoting the latch elements into their retracted positions to cause them to disengage the lower end of the coupling when it is desired to remove the housing from the upper end of the tubing string; and an annular seal within and carried by the housing above the latch means and having an upwardly extending annular lip engageable with the periphery of the coupling above the lower end thereof when the housing is slipped over the upper end of the tubing string, whereby fluid pressure within the tubing string acts downwardly and inwardly on the annular lip, upon closure of the shutoff valve, to urge the lip inwardly into fluid-tight engagement with the periphery of the coupling.

A further object is to provide a latch means wherein the latch elements have portions of arcuate cross section seated in an upwardly facing, annular groove of arcuate cross section which is formed in the housing, thereby providing simple pivotable connections between the latch elements and the housing.

Yet another object is to provide a shutoff device whereing the spring means for biasing the latch elements into their extended positions comprises simply an annular tension spring encircling and engaging the latch elements.

A further object is to provide a shutoff device wherein the retracting means for the latch elements comprises an external collar slidable axially of the housing and engageable with arms on the latch elements which project outwardly through the housing.

Still another object of the invention is to provide an alternative embodiment having some or all of the foregoing characteristics, except that the latch elements are slips having teeth engageable with a tubing, or a flush joint between tubing sections.

The foregoing objects, advantages, features and results of the present invention, together with various other objects, advantages, features and results thereof which will be evident to those skilled in the art in the light of this disclosure, may be achieved with the exemplary embodiments of the invention described in detail hereinafter and illustrated in the accompanying drawing, in which:

FIG. 1 is an elevational view on a reduced scale showing a well head installation which incorporates the invention;

FIG. 2 is an enlarged, fragmentary, vertical sectional view taken along the arrowed line 2—2 of FIG. 1;

FIG. 3 is a fragmentary, vertical sectional view similar to FIG. 2, but in a different vertical plane; and

FIG. 4 is a fragmentary, vertical sectional view similar to a portion of FIG. 2, but illustrating an alternative embodiment of the invention for use in the absence of an externally projecting coupling.

In the drawing, the numeral 10 designates a well head from which a tubing string 12 projects upwardly. The tubing string 12, as is conventional, is sectional, each section being coupled to the next by a coupling one of which is designated in FIGS. 2 and 3 by the numeral 14. In running the tubing string 12 into or out of the well, it is conventional for one of the couplings 14 to be present at the upper end of the tubing string at all times.

The present invention provides a quick-connect shutoff device 16 adapted to be slipped over the upper end of the tubing string 12 and to latch onto the conventional coupling 14 at the upper end thereof. With this construction, the shutoff device 16 may be placed in operation very quickly and easily, whenever this is necessary to shut off a surge of fluid, without the provision of any special engagement means on the tubing string, which is an important feature.

Considering the shutoff device 16 of the invention, it includes a tubular housing 18 having an enlarged lower end 20 adapted to be slipped over the upper end of the tubing string 12 and to enclose the coupling 14 thereon. A shutoff valve 22 is connected to the upper end of the housing 18 and is adapted, when closed, to prevent upward flow therethrough. If desired, a suitable fluid conducting line 24 may be connected to the upper end of the shutoff valve for conveying fluid to a suitable point of disposal. However, this is not essential.

The housing 18 is provided within the enlarged lower end 20 thereof with an upwardly facing, annular groove 26 of arcuate cross section. Within the enlarged lower

end 20 of the housing 18 above the annular groove 26 is an annular latch means 28 engageable with the lower end of the coupling 14. More particularly, the annular latch means 28 comprises a segmental or split latch ring including circumferentially spaced latch elements 30. These latch elements have portions 32 of arcuate cross section seated in and pivotable in the annular groove 26 so that the latch elements may pivot inwardly and outwardly between inner, extended positions, shown in FIG. 2, and outer, retracted positions, shown in FIG. 3. The latch elements are provided at their upper ends with latch surfaces 34 generally perpendicular to the axis of the shutoff device 16 and seatable against the lower end of the coupling 14. The latch elements 30 are also provided with inner, cam surfaces 36 engageable with the upper end of the coupling 14 as the housing 18 is slipped over the upper end of the tubing string 12 to pivot the latch elements outwardly into their retracted positions.

The latch elements 30 are pivoted inwardly into their extended positions, after they have been slipped downwardly past the lower end of the coupling 14, by a spring means comprising an annular tension spring 38 encircling the latch elements and disposed in a discontinuous, external annular groove therein. With this construction, the latch elements 30 automatically snap inwardly into their extended positions so that the latch surfaces 34 thereof may engage the lower end of the coupling 14.

The shutoff device 16 includes a movable retracting means 42 carried by the housing 18 and engageable with the latch elements 30 for simultaneously pivoting the latch elements outwardly into their retracted positions. The retracting means 42 comprises an external collar 44 slidable axially on the enlarged lower end 20 of the housing 18 and engageable with arms 46 on the latch elements 30 which extend radially outwardly through the housing. As will be apparent, by sliding the collar 44 downwardly, the latch elements 30 are pivoted outwardly into their retracted positions so as to permit disengagement of the shutoff device 16 from the tubing string 12. The collar 44 is provided with handles 48 for this purpose.

Within the housing 18 above the latch means is a radially-inwardly-facing annular groove 50 containing an elastomeric annular seal 52 having an upwardly extending annular lip 54 which is engageable with the periphery of the coupling 14 intermediate the ends thereof. With this construction, when the shutoff device 16 is in place and the shutoff valve 22 thereof is closed, any fluid pressure within the tubing string 12 acts on the outer surface of the annular lip 54 to bias the annular lip inwardly into fluid tight engagement with the periphery of the coupling 14. Thus, the annular seal 52 is self energizing.

Considering the operation of the invention, whenever, in the course of running the tubing string 12 into or out of the well, an upward fluid surge is encountered, the shutoff device 16 is slipped over the upper end of the tubing string. To facilitate doing this, the shutoff device may be suspended on a cable, or the like, not shown, so that it may be swung into position quickly and easily.

As the shutoff device 16 is dropped over the upper end of the tubing string 12, the coupling 14 thereon automatically cams the latch elements 30 outwardly into their retracted positions, the annular tension spring 38 automatically snapping the latch elements 30 inwardly into their extended positions as these latch elements pass the lower end of the coupling. At the same time, the annular seal 52 engages the periphery of the coupling. At this point, the shutoff valve 22 is closed, whereupon the fluid surging upwardly through the tubing string 12 is confined. The fluid pressure causes the latch surfaces 34 to seat against the lower end of the coupling 14, and simultaneously urges the annular lip 54 of the seal 52 into fluid tight engagement with the exterior of the coupling to prevent leakage. If desired, the shutoff valve 22 may be left open to permit disposal of the fluid flowing upwardly through the tubing string 12 by way of the conducting line 24.

Once the condition outlined above has dissipated, the shutoff device 16 may be removed from the tubing string 12 readily by pushing downwardly on the handles 48 of the collar 44 to cause the collar to retract the latch elements 30. Thereupon, the shutoff device 16 may be removed and the operation of running the tubing string 12 into or out of the well continued.

Referring to FIG. 4 of the drawings, illustrated therein is a shutoff device 116, for use with a tubing string 112, which is similar to the device 16, the parts of the device 116 being identified by reference numerals higher by one hundred than those used to identify the corresponding parts of the device 16.

The shutoff device 116 differs from the device 16 principally in that the latch surfaces 134 are generally parallel to the axis of the device 116 and are provided with serrations or teeth 135 adapted to engage the tubing string 112 in the absence of an externally projecting coupling, or at a location spaced from such a coupling. In effect, the latch elements 130 are slips which prevent upward movement of the shutoff device 116 relative to the tubing string 112.

It will be noted that no spring means corresponding to the spring means 38 is provided in the shutoff device 116. The reason is that the latch elements 130 are self energizing and grip more firmly the higher the upward force applied to the device 116. The latch elements 130 automatically engage the tubing string 112 under the influence of gravity if, for example, they are initially cammed outwardly by an externally projecting coupling engaging the cam surafces 136 as the device 116 is slipped thereover. More particularly, the centers of gravity of the latch elements are located radially inwardly of the centers of the arcuate portions 132 thereof so that they automatically fall inwardly against the tubing string 112, unless held in, or moved into, their retracted position by the retracting collor 144 acting downwardly on the arms 146.

The structure and operation of the shutoff device 116 are otherwise similar to the device 16 so that a further description is not required.

Although exemplary embodiments of the invention have been disclosed herein for purposes of illustration, it will be understood that various minor changes, modifications and substitutions may be incorporated in such embodiments without departing from the spirit of the invention as defined by the claims which follow.

I claim:

1. In a quick-connect fitting for an oil well tubing string, the combination of:

(*a*) a tubular housing adapted to be slipped over the upper end of the tubing string;

(*b*) latch means comprising circumferentially spaced latch elements within said housing and pivotable inwardly and outwardly relative thereto between inner extended positions, wherein they are engageable with the tubing string, and outer retracted positions, said latch elements having inner cam surfaces engageable with the upper end of the tubing string to pivot said latch elements outwardly into their retracted positions as said housing is slipped over the upper end of the tubing string;

(*c*) movable retracting means carried by said housing and engageable with said latch elements for simultaneously pivoting said latch elements into their retracted positions to cause them to disengage the tubing string when it is desired to remove said housing from the upper end of the tubing string;

(*d*) said latch elements respectively having arms extending outwardly through said housing; and

(*e*) said retracting means including a collar externally of and slidable axially along said housing and engageable with said arms.

2. In a quick-connect fitting for an oil well tubing string, the combination of:

(*a*) a tubular housing adapted to be slipped over the upper end of the tubing string;

(*b*) latch means comprising circumferentially spaced latch elements within said housing, said latch elements having serrated surfaces and being pivotable inwardly and outwardly relative thereto between inner extended positions, wherein said serrated surfaces are engageable with the tubing string, and outer retracted positions, said latch elements having inner cam surfaces engageable with the upper end of the tubing string to pivot said latch elements outwardly into their retracted positions as said housing is slipped over the upper end of the tubing string;

(*c*) movable retracting means carried by said housing and engageable with said latch elements for simultaneously pivoting said latch elements into their retracted positions to cause them to disengage the tubing string when it is desired to remove said housing from the upper end of the tubing string;

(*d*) said latch elements respectively having arms extending outwardly through said housing; and

(*e*) said retracting means including a collar externally of and slidable axially along said housing and engageable with said arms.

3. In a quick-connect fitting for an oil well tubing string including a coupling at its upper end, the combination of:

(*a*) a tubular housing adapted to be slipped over the upper end of the tubing string and to enclose the coupling at the upper end thereof;

(*b*) latch means comprising circumferentially spaced latch elements within said housing adjacent the lower end thereof and pivotable inwardly and outwardly relative thereto between inner extended positions, wherein they are engageable with the lower end of the coupling, and outer retracted positions, said latch elements having inner cam surfaces engageable with the upper end of the coupling to pivot said latch elements outwardly into their retracted positions as said housing is slipped over the upper end of the tubing string;

(*c*) spring means engaging said latch elements and biasing them inwardly into their extended positions for causing said latch elements to engage the lower end of the coupling as said housing is slipped over the upper end of the tubing string;

(*d*) movable retracting means carried by said housing and engageable with said latch elements for simultaneously pivoting said latch elements into their retracted positions to cause them to disengage the lower end of the coupling when it is desired to remove said housing from the upper end of the tubing string;

(*e*) said latch elements respectively having arms extending outwardly through said housing; and

(*f*) said retracting means including a collar externally of and slidable axially along said housing and engageable with said arms.

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