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THREADLESS TYPE WELL TUBING SAFETY JOINT

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Fig. 1

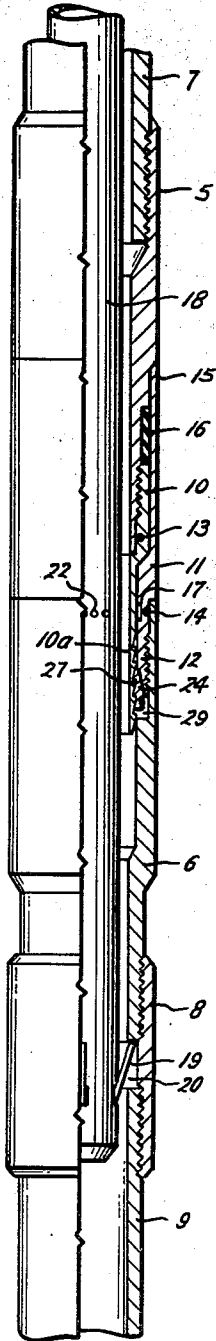


Fig. 2

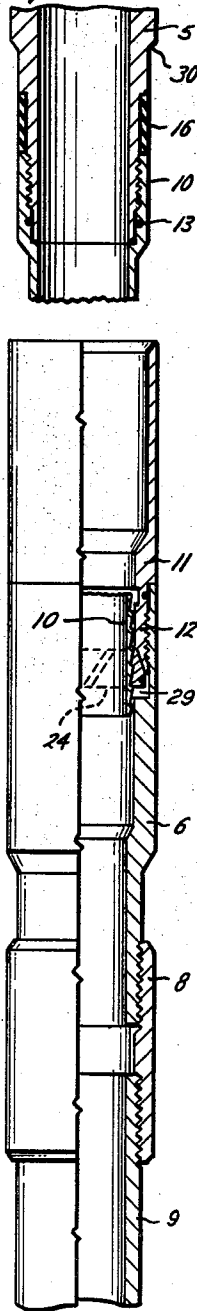
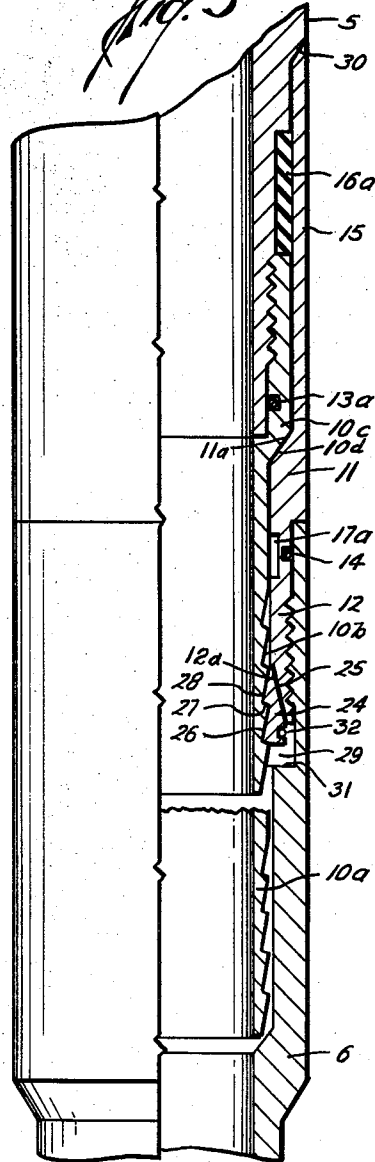


Fig. 3



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THREADLESS TYPE WELL TUBING SAFETY JOINT

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4 Claims. (Cl. 285-18)

This invention relates to so-called safety joints for well tubing or casing strings, which facilitate intermediately severing the string to permit removal from the well of the upper part only thereof.

Previous safety joints have involved either threaded couplings which require rotation of the part of the tubing string which is to be removed, or weakened elements which may be torn apart by longitudinal jarring action. The first type is not always practical, particularly where projections on the tubing, such as gas lift valves, prevent rotation thereof. The second type have the disadvantage of constituting a permanent weakness in the tubing string which may not carry forces incident to normal running and supporting of the string. Furthermore, there has been no practical way to reassemble the unthreaded or severed tubing strings, except with the use of an overshot coupling which may require more well space than is available.

Accordingly, the main object of the present invention is to provide a tubing or casing safety joint device which avoids the above stated disadvantages.

A more detailed object is to provide a safety joint which may be severed by the use of a commercial tubing or casing cutter, either of the mechanical or chemical type, without damaging the juxtaposed portion of the joint which remains with the set tubing or casing.

Another object is to provide a safety joint which may be reassembled after the severing operation, yet which is full opening internally and of substantially the same external dimension as a tool joint or coupling.

Still another object is to provide a safety joint which does not involve a portion which is so structurally weakened as not to resist normal running and supporting forces applied to the tubing or casing string.

These objects and others are accomplished in my novel safety joint which consists, essentially, of end portions for connection in the tubing or casing string and one or more tubular, telescoped, intermediate members which are structurally secured to the end portions of the joint. The intermediate member, or one of them, has a restricted, relieved portion permitting cutting thereof by a commercial tubing or casing cutting tool without damaging the juxtaposed joint structure. After severing, the upper portion of the joint and attached tubing or casing string may be withdrawn. Sealing means are provided between the separable portions of the joint so that these portions may be sealably re-engaged. In the preferred form, a pair of intermediate members are provided which mount a one-way latch structure which prevents longitudinal separation of the coupled pipe strings, yet permits the severed remnant of the cut member of the joint to be displaced longitudinally to permit substitution therefor of a replacement member with coupled upper string portion.

In the accompanying drawings which illustrate the invention:

FIG. 1 is an elevation partly cut away and sectioned, illustrating the novel safety joint inserted in a tubing string;

FIG. 2 shows the joint in severed condition and with the upper portion longitudinally separated therefrom; and

FIG. 3 is a view, substantially enlarged, showing the

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coupling reassembled with a replacement for the severed member thereof.

The novel coupling device or safety joint consists of upper and lower end portions or subs 5 and 6, the former being internally threaded for attachment to the threaded lower end of tubing 7. The lower portion 6 is externally threaded for attachment by means of a coupling 8 to tubing 9. The device also includes a first, tubular, intermediate member or release nipple 10 which is threadably secured at its upper extremity to the lower end of joint end portion upper sub 5 so that, in effect, parts 5 and 10 form a rigidly connected, continuous inner tubular member. Telescopingly received about first intermediate member 10 is a second, tubular, intermediate member or landing bushing 11 which is threadably secured at its lower or telescoped extremity 12 to the upper end of joint lower end portion 6. Parts 11 and 6, thus form a continuous, tubular outer member having a smooth faced inner wall normally slidably fitting the similar outer wall of inner tubular member 5, 10. Annular shoulders 10d and 11a, respectively, on members 10 and 11, limit relative movement of these members in one direction, that is, together. O-ring seals 13 and 14 are provided between the intermediate members and the joint end subs 5 and 6 secured thereto. The upper or telescoped extremity 15 of landing bushing 11 slidably receives by stab type fit the adjacent portions of release nipple 10 and joint upper sub 5 and a sealing packing 16 is provided therebetween. The inner face of portion 12 of bushing 11, between its extremities, is provided with a restricted, radially relieved portion 17 which permits severing of the relatively thin adjacent part 10a of the release nipple, as by means of a chemical cutter represented at 18, without substantially damaging the juxtaposed part of outer member 11. The cutter is provided with positioning fingers 19 which cooperate with coupling clearance space 20. Cutter 18 has an annular series of holes 22 through which chemical cutting material is forcefully ejected for cutting the adjacent tubing. A commercial cutter of the mechanical type may be substituted for the chemical cutter shown.

Interposed between the lower portions 10a and 12 of telescoped members 10 and 11 is a one-way resilient, expandable and contractible latching structure which constitutes a structural attachment capable of carrying tension forces between the telescoped members 10 and 11 and to prevent separation thereof. The latching structure consists of a split ring or nut, generally indicated at 24, having a downwardly and outwardly tapered outer surface 25 (FIG. 3) which snugly seats in a complementary similarly inclined cam element 12a provided at the lower end of outer member 11, 12. The inner surface of the split ring is provided with a buttress thread or ridging 26 with axial force-transmitting lower faces 27 at an angle of substantially more than 45° to the axis of the joint, preferably normal or nearly normal thereto. The intermediate faces 28 of the thread are at angles of substantially less than 45° with the joint axis. The threads 26 on the latching ring couples with the similarly shaped threads 10b on the lower portion 10a of inner or release nipple member 10. Split ring or nut 24 extends substantially below the lower end of outer member 11 into a clearance 29 provided therefor in the inner wall of joint lower end portion 6. The lower wall of recess 29 is defined by a radial shoulder 31, while the inclined cam surface 12a bounds the top of the recess. This clearance permits sufficient circumferential expansion of split ring or nut structure 24 to permit the lower extremity of inner or release nipple member 10 to be stabbed thereinto and to be displaced longitudinally therethrough as will be explained hereafter. A circular spring 32 received snugly about split ring 24 resiliently resists expan-

sion thereof. It is contemplated that the nut structure will be threaded upon the lower end of member 10, but the mating faces of the nut structure and part 10a could readily be provided with non-spiral ridging and/or grooving shaped in section like the buttress threads. In this case, the initial assembly would be made by driving the split ring structure endwise upon the reduced lower end 10a of member 10.

Upon severing of release nipple member 10 by means of a suitable cutter, the upper portion of the nipple and the coupled upper portion of the tubing string may be withdrawn upwardly, as shown in FIG. 2. The remnant 10a of the severed release nipple member is maintained in position by latching nut structure 24. In order to reassemble the safety joint, the upper severed portion of the release nipple member is unscrewed from joint upper end portion 5, after this portion of the string is removed from the well, and a replacement release nipple member 10c substituted therefor with renewed packings 16a and 13a. Thereupon, tubing string 7 is reintroduced into the well and the reduced lower extremity of substitute nipple member 10c guided or stabbed into the open, upper end of landing bushing member 11. The serrated or buttress threaded lower extremity of substitute nipple 10c is forced through split latch nut structure 24 until the upper end of landing bushing 11 seats against shoulder 30 provided therefor in joint upper end portion 5. At such time, renewed sealing packing 16a will prevent leakage between the landing bushing and the received portions of joint end portion 5 and substitute member 10c. Clearance 29 will permit sufficient radial expansion of the nut structure to permit interlatching with substitute member 10c. The shape of the serrations or teeth provided on nut structure 24 will, of course, tensionally secure together, that is, prevent longitudinal separation of joint end portions 5 and 6 and the coupled tubing or casing strings. FIG. 3 also more clearly shows the radially relieved restricted annular zones 17a in the inner wall of the threaded intermediate part 12 whereby member 10c may be severed, as before, if necessary. Nut structure 24 may consist of annularly arranged, separate segments, in the manner of wedging slips. The novel joint, may be inserted in a casing string instead of the tubing string as shown. The invention may be modified in this and other respects as will occur to those skilled in the art and the exclusive use of all modifications as come within the scope of the appended claims is contemplated.

What is claimed is:

1. A safety joint for pipe strings comprising outer and inner tubular members having smooth faced adjacent wall surfaces adapted to receive by a stab type fit the inner tubular member within the outer tubular member with the tubular members being in telescoping relationship relative to each other,

means for limiting relative travel of the tubular members in a given direction,

said inner tubular member having a series of connected surfaces each inclined toward the axis of the inner tubular member and defining annular latching elements,

a substantially radial shoulder on the inner wall of the outer tubular member for defining one wall of an annular recess therein,

an upwardly and inwardly inclined wall axially spaced from said shoulder for defining another wall of said annular recess,

said annular recess in the outer tubular member being disposed adjacent the annular latching elements of the inner tubular member when said tubular members are disposed in the telescoping relationship by the stab type fit,

resilient annular latching structure expandably and

contractably disposed within the confines of the annular recess,

said latching structure having a series of connected surfaces for defining complementary latching elements disposed in cooperating relationship with the latching elements of the inner tubular member, cam means defined by the outer peripheral portion of the annular latching structure for engagement with the inclined wall of the recess in the outer tubular member,

said cam means being effective to urge the latching elements of the annular latching structure into interlocking engagement with the latching elements of the inner tubular member on relative movement of the tubular members in the given direction while restraining relative movement of the tubular members in another direction that is opposed to the given direction,

a device establishing a locale for enabling an end portion of the inner tubular member to be severed therefrom without substantial damage to the outer tubular member,

said locale being at a location which is a given distance from the end portion of the inner tubular member when said tubular members are disposed at the limit of telescopic travel, and

an arrangement for receiving an end portion of the inner tubular member after such end portion thereof has been severed therefrom,

said arrangement extending from the end portion of the inner tubular member which is to be severed and terminating a distance therefrom which is at least equal in extent to the given distance that the locale of the device is located from the end portion of the inner tubular member with the arrangement being of sufficient size to accommodate the end portion of the inner tubular member after the end portion has been severed therefrom,

said tubular member and the latching structure disposed in the recess defined by the shoulder and the inclined wall of the outer tubular member together with the latching elements, the cam means, the device and the arrangement being constructed and arranged to enable the end portion of the inner tubular members to be severed adjacent the device and then urged by a replacement inner tubular member past the latching structure into the said arrangement.

2. A safety joint as described in claim 1 in which said latching structures is in the form of a discontinuous ring and further includes spring means resisting radial expansion of said structure.

3. A safety joint as described in claim 1 in which said complementary buttress elements are formed as buttress threads constructed to resist relative movement of said tubular members in said opposite direction while enabling relative motion in said first direction between said end portion of said inner member, when severed, and said latching structure.

4. A safety joint as described in claim 1 in which said inner tubular member is formed of two separable parts, a first for attachment to the pipe string and a second attached to said first part and including said severable end portion.

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