

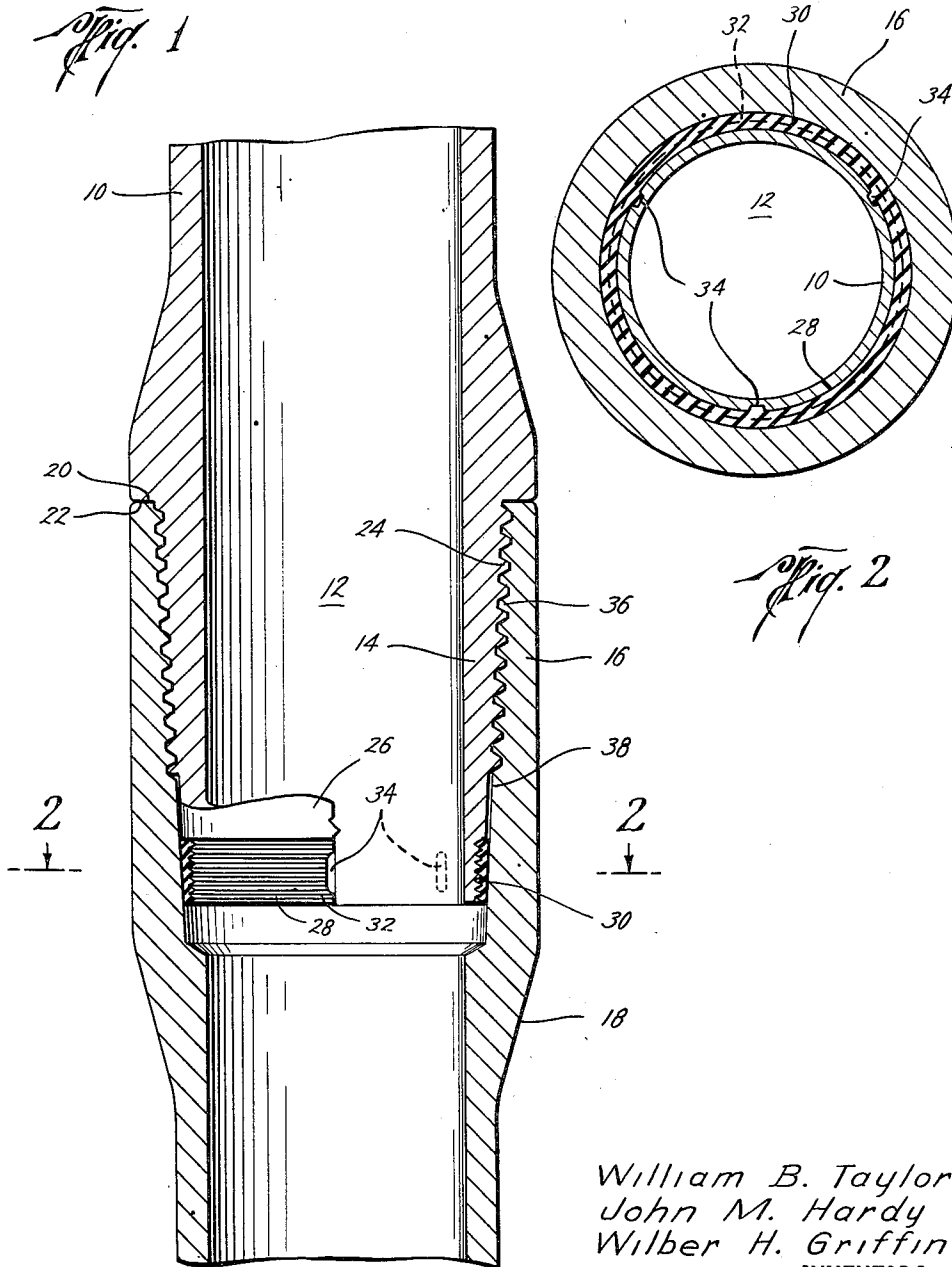
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PIPE COUPLING HAVING A TEFLON SEALING GASKET

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1

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PIPE COUPLING HAVING A TEFLON SEALING GASKET

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This invention relates to sealed joints and couplings.

While the present invention is useful for a variety of purposes it is particularly adapted for use in the drilling of oil, gas and like wells and the description, for the purpose of disclosure, is directed toward that use. Other uses, of course, will readily suggest themselves to those skilled in the various arts.

In the drilling of oil, gas and like wells, it is customary to drill to the desired formation or formations, cement casing in place in the well bore and provide tubing extending downwardly in the well bore from the surface inside the casing, the annular space between the casing and tubing being packed off by packer; although, many wells are produced without a packer. Ordinarily, the casing is perforated at the face of the formation or is set above the formation traversed by the well bore and a section of tail pipe is provided below the packer, the tail pipe which may be perforated or slotted or open-ended so that, ordinarily, pore fluid from the formation flows into the well bore, such as through the perforations in the casing or below the casing and into the interior of the well bore into the tubing or casing up to the surface or is pumped therethrough. In some instances, the flow is in the annular space between the tubing and the casing such, as for example, in the case of dual or multiple completions where one formation is being produced in the tubing and another formation is being produced in the annular space between the tubing and the casing.

In producing oil, gas and like wells, particularly in those wells under high pressure, many joints in the tubing fail and permit oil, gas and the like to leak through the tubing into the annular space which provides a high pressure on the casing at the surface, which is the weakest point of the various strings of pipe positioned in the well bore. These leaking joints are ordinarily caused due to the failure to obtain a satisfactory seal, such as caused by normal wear and tear, improper machining and, in those joints utilizing packing by the corrosive action of the fluid in the well bore.

Also, in many cases it would be advantageous to utilize the pipe by which the well is drilled as the casing, so that in the last trip in the well bore, the drill pipe may be cemented in place, and the well completed, the pipe serving the purpose of the casing. This would be particularly advantageous over casing now used as it would minimize leakage through the joints, for example, in high pressure wells.

Similarly, it would be advantageous to provide a joint or coupling in which the string of pipe could be run without its packing and, in the event it would be desired to squeeze cement or squeeze acid into a formation under pressure or to make formation (drill stem) tests and the like this may be accomplished by adding the packing elements to the joints or couplings.

Also, in various couplings and joints utilizing packing now in use considerable care must be taken to use pipe dope of the type which does not affect the packing utilized or which prevents a complete make-up, that is a sealed make-up of the joint, particularly in those joints having close tolerances.

In addition it would be advantageous to provide a packed off or sealed joint or coupling which does not have to be machined as accurately as present joints and

2

couplings and in which normal wear does not affect the sealing qualities of the joint or coupling.

It is therefore an object of the present invention to provide a joint or coupling which may be incorporated in strings of pipe used in the drilling and/or production of oil, gas and like wells which resist the chemical action, pressures and temperatures of the fluid in the well bore.

It is yet a further object of the present invention to provide a coupling or tool joint which may be incorporated in a string of pipe or tubing and which may be used with the sealing or packing member omitted, but such sealing or packing members may readily be added so that squeezing or acidizing or testing operations, such as drill stem testing, may be performed with the same string of pipe or tubing used in the drilling of the well or the string of pipe or tubing may be cemented in the well and the well completed, the string of pipe or tubing serving as the casing.

It is yet a further object of the present invention to provide such a coupling or tool joint in which the use of pipe dope of various kinds does not affect the sealing qualities of the joint and which provides an efficiently-sealed joint or coupling.

Yet a further object of the present invention is the provision of such a coupling or joint in which normal wear on the various parts of the coupling or joint does not cause the joint to leak but in which the packing accommodates such wear.

Yet a further object of the present invention is the provision of such a joint or coupling which utilizes a packing of nonadhering quality, one which resists the chemical action of fluids, and which is relatively stiff and non-resilient, yet one in which the packing may readily and easily be inserted in the joint and yet, when the joint is uncoupled or disconnected the packing will remain in place on the member it is placed.

A more particular object of the present invention is the provision of a coupling or joint of the above character which is provided with a packing band formed of polymerized polytetrafluoroethylene.

A further object of the present invention is the provision of a process which comprises completing the well with the string of pipe or tubing by which the well is drilled and thereby utilizing the string of pipe or tubing as the casing.

A further object of the present invention is the provision of a process which includes lowering a string of pipe or tubing into a well drilled to known producing horizons which includes a seating nipple on the lower end for installing pumping equipment and the like.

Yet a further object of the present invention is the provision of a method comprising applying packing rings to the joints or couplings of the string of pipe or tubing used in drilling the well, then lowering the packed off pipe or tubing into place in the well bore, cementing it and completing the well through the pipe or tubing which serves as the casing for the well.

Yet a further object of the present invention is the provision of a method of completing a well in which casing has been cemented in place comprising drilling the cement with a string of tubing having packed-off joints connecting it together and fixing this string of tubing in place in the well for producing the well therethrough thereby avoiding the additional steps and expense of drilling the cement with drill pipe and removing the drill pipe from the well before lowering tubing into place in the well.

Other and further objects, advantages and features of the invention will be apparent from the following description of an example of the invention, given for the purpose of disclosure, and taken in conjunction with the accompanying drawing, where like character references designate like parts throughout the several views, and where

FIGURE 1 is a side elevation, in section, illustrating a joint constructed according to the invention, and

FIGURE 2 is a cross-sectional view taken along the line 2-2 of FIGURE 1.

The numeral 10 designates a pin member of the coupling or joint generally indicated by the reference numeral 12, and which has the first reduced diameter or pin portion 14 which extends downwardly and fits into the upwardly extending box 16 of the box member 18 when the coupling or joint is made up.

The reduced diameter portion or pin 14 provides a downwardly facing annular shoulder 20 on the body of the pin member 12 which may abut against the upper annular end 22 of the box 16 when the joint is made up.

The reduced diameter portion or pin 14 is tapered downwardly and inwardly and is provided with the threads 24 disposed on its exterior surface. The threads 24 stop short of the lower end of the pin 14, however, to provide what is in effect a run-out portion 26 which has the same taper as the remainder of the pin 14. The lowermost or terminal end of the pin 14 has a second reduced diameter portion at 28 to receive the packing ring 30, which packing ring is of critical construction as will be apparent later. As will be described in more detail later, the packing ring 30 is formed of a non-adhering and relatively stiff material and in order to retain the packing ring 30 on the second reduced diameter portion 28 at the terminal end of the pin 14, friction means are provided thereon, which may take the form of the relatively fine threads or V-grooves 32 and circumferentially-spaced axially extending grooves 34, although any desirable friction means may be utilized for this purpose, whether integral or applied thereto.

As mentioned previously, the box 16 receives the pin 14 and the inner upper part of the box 16 is provided with a taper complementary to that of the pin 14 and is provided with the threads 36 which interfit in threading relation with the threads 24 on the pin member.

The inner end of the box member 16 is tapered the same as that of the upper portion and complements and snugly fits about the terminal end 26 and packing 30 disposed about the pin 14, as indicated at 38. Thus, the packing 30 is wedged against the outer terminal end 28 of the pin 14 and the inner end 38 of the box 16 when the joint or connection 12 is made up.

The packing band 30 is of critical construction and is formed of polymerized tetrafluoroethylene. This composition of matter is described in United States Patent No. 2,230,654, issued February 4, 1941 on the application of Roy J. Plunkett and the formation or fabrication of gaskets and packing bands of polytetrafluoroethylene is further described in United States Patent No. 2,456,262, issued December 14, 1948 on the application of Reuben T. Fields. The manufacture of this material is further described in Ind. and Eng. Chemistry, vol. 39, page 870, September 1946, and is sold by E. I. du Pont de Nemours and Co. under the trade-name "Teflon." This material is characterized by its chemical inertness which is characteristic from extremely low temperatures up to about 572° F. Through this wide temperature range it resists the attack of corrosive reagents and dissolution by solvents.

Molded polymerized polytetrafluoroethylene is a tough waxy solid, white to gray in color and is highly resistant to abrasion. This material, however, is not resilient and it is necessary, therefore, to provide particular construction so that it may successfully be used as a packing ring in joints, couplings and the like.

Thus, as illustrated in the drawing, the packing ring 30 formed of polymerized polytetrafluoroethylene may readily be slipped over the lower end 28 of the pin member 14 and, due to its lack of resilience, when it is compressed between the friction surface 32 and the taper surface 38 in the box 14, it will tend to remain in deformed position so that upon disconnecting the joint 12 it remains on the pin member 14 and does not come off the pin and become lost in the bore of the pipe and the like.

It should be noted that the outer wall of the packing band 30 is formed substantially on the same taper as the surfaces 26 and 38 of the pin 14 and box members 16, except that it extends slightly beyond the surface 26 of the pin member 14. This may be accomplished by having the lower end 28 of the pin member tapered or it may be straight and the taper formed in the packing 30. In any event, however, it is desirable to have the packing band 30 manufactured to fit the particular construction utilized.

It is unnecessary to provide a complementary threaded surface on the interior wall of the packing band 30, as the packing band is deformed when it is made up and compressed between the walls 28 and 38 of the pin 14 and box 16, respectively. Also, with a construction according to the invention, it is unnecessary to completely make up the connection 12 as an efficient seal is provided although the shoulders 20 and 22 may not be in engagement with one another. In addition, wear on the threads 24 and 36 does not affect the sealing or packing qualities of the joint as the joint merely needs to be made up a little tighter to further compress the packing ring 30.

In using a tool joint in accordance with the invention, the joint or coupling 12 may be incorporated in a string of pipe in the usual manner and the packing band 30 may be inserted over the lower end 28 and about the friction surface 32 of the pin 14. Thus, the joints may be made up in sealing connection as they are lowered into the well bore in the usual manner. As mentioned previously, the joint or coupling of the present invention is particularly advantageous in that drill stem tests squeeze jobs, such as acidizing and cementing, may be made through the string of pipe. Also, in completing wells, whether single, dual or multiple completions, the coupling or joint may be incorporated in strings of tubing with the assurance that corrosive action of the fluids in the well bore will not attack and affect the packing 30 and thereby cause leaks in the tubing thereby eliminating costly operations in removing the tubing and reworking the well and eliminating hazards of blowouts and the like. The joint or coupling 12 is further advantageous in that any type of thread dope may be used on the threads 24 and 36 without affecting the packing 30 and normal wear on the threads does not affect the sealing quality of the packing 30.

Also, if desired, in operation, in disconnecting the coupling 12, such as when removing pipe from a well bore, the packing band 30 stays in place on the pin member, as previously described.

Also, the tool joint 12 may be run without the packing 30 and, when desired to have a sealed coupling or connection between the various lengths of pipe which are connected or coupled thereby, the packing band 30 may easily and readily be slipped over the end of the pin 14 to provide a completely sealed string of pipe for the purpose of producing well reservoirs, running tests, squeezing, acidizing, or utilizing the drill string as a casing, that is on the last trip placing the packing bands 30 over the lower end of the pins 14 and lowering the drill string into the well bore, cementing it in place and completing the well in a desired manner, the drill string serving the purpose of the casing.

It is thought that the method of the invention is clear from the foregoing; however, broadly, the method includes lowering the string of pipe or tubing used to drill the well bore into the well bore, the joints or couplings of the string of pipe or tubing either having packing bands or rings applied thereto or applying them as the string of pipe is made up and lowered into the well bore. The string of pipe or tubing is cemented in place after being positioned in the well bore as desired, and the well is completed, the string of pipe or tubing serving as the casing. Of course, auxiliary equipment or tools may be attached to or used in conjunction with the string of pipe or tubing when it serves as the casing; for example, in drilling to known producing formations which are to be pumped, a seating nipple may be placed on the lower end

5

of the string of pipe or tubing for installation of pumping equipment.

It should be noted that the method of the invention includes the use of packing elements formed of materials other than polymerized polytetrafluoroethylene although this material is highly advantageous for use in the method of the invention. If other materials, are used, they should be able to resist the pressures, heat and corrosive action of the fluids encountered in the well bore.

It is therefore apparent that a coupling or tool joint constructed according to the present invention and a method in accordance therewith attains the objects and has the advantages and features mentioned as well as others inherent therein and may advantageously be adapted for a wide variety of uses and conditions.

Various changes in details of construction and rearrangement of parts may be made within the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. A tool joint comprising a pin member, a first reduced diameter portion projecting from the pin member, a second reduced diameter portion at the terminal end of the first reduced diameter portion, a friction surface comprised of relatively fine threads on the second reduced diameter portion, a packing band formed of polymerized polytetrafluoroethylene disposed about the second reduced diameter portion and engaging the friction surface, a box member, said box member receiving said first and second reduced diameter portions in interfitting relationship when the joint is made up, and interengaging threads on the

6

first reduced diameter portion and in the box, said packing sealingly engaging an inner wall of the box interiorly of the threads and being compressed and deformed against the friction surface when the joint is made up.

2. The tool joint of claim 1 including circumferentially spaced and axially-extending grooves disposed on the second reduced diameter portion.

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