March 24, 1942. F. MORGAN 2,277,601

TOOL

Filed March 25, 1940

Fig. 1.

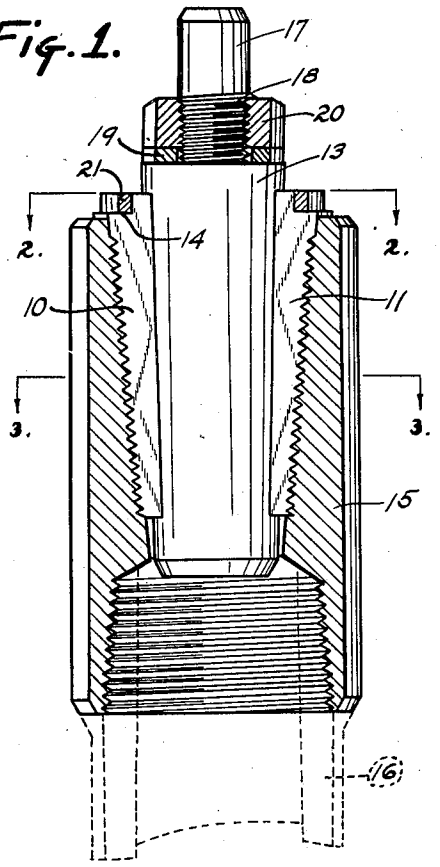


Fig. 4.

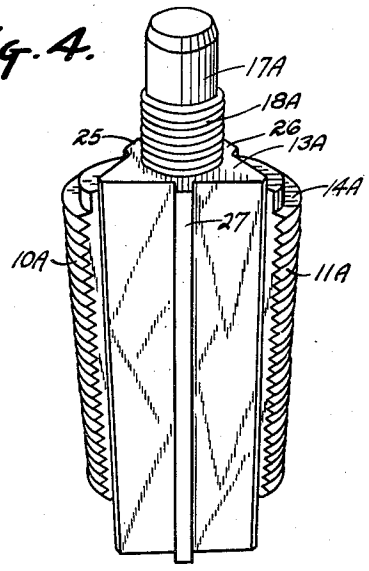


Fig. 5.

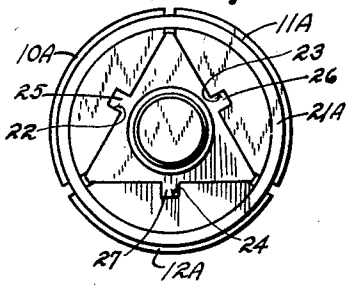


Fig. 2.

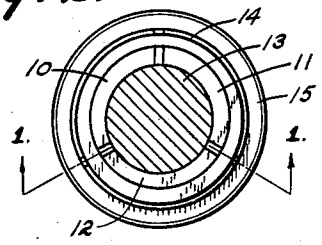
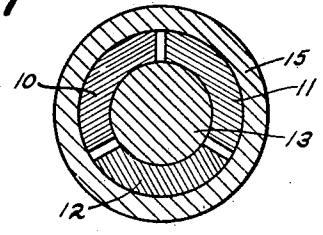


Fig. 3.



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2,277,601

TOOL

Frank Morgan, Healdton, Okla.

Application March 25, 1940, Serial No. 325,797

4 Claims. (Cl. 266—2)

This invention relates to tools, and more particularly to a tool for facilitating the rebuilding of the box members of tool joints of well drilling equipment.

To those familiar with the production phase of the oil industry, a tool joint is simply another name for a specific type of coupling for connecting the ends of two sections of drill pipe together. The female portion of a tool joint is called the box, and it has a tapered, threaded recess for receiving the complemental tapered, threaded male portion of the joint, this male portion being called the pin. The box and pin have complemental shoulders which abut to hold the two parts of the joint in rigid alignment after the pin is screwed tightly into the box. The box and pin of most tool joints are made separate from the drill pipe, and simply screw onto the ends of the various drill pipe sections which are to be connected together. A few companies are now beginning to make the respective parts of the tool joint integral with the opposite ends of each section of the drill pipe. In either case it is necessary to make the outside diameter of both the box member and the pin member larger than the outside diameter of the drill pipe section, so that the bore through the tool joint may be made sufficiently large to afford free circulation of fluid through each joint in an assembled string of drill pipe. Due to the extreme abuse to which they are subjected, these joints are usually extruded from solid forged steel slugs or bars, are especially heat treated for hardness, and the threads are cut after the hardening process so as to assure the longest possible wear. Due to the hardness of the metal, the re-cutting of these threads requires specially designed and expensive equipment not available in the oil fields.

In use, the frictional contact of the exterior surfaces of these tool joints with the well casing and with the earth and rock walls of a well during the drilling operation as well as during the frequent raising and lowering of the entire string of drill pipe from and into the well, wears the wall of these tool joints so thin that they are no longer fit for safe or economical use. The frequent joining and disjoining of the two parts of each joint also wears the tapered threads. The replacing of tool joints throughout the entire string of drill pipe is costly. A much less costly solution is a rebuilding of the tool joints at as low a cost as possible at or nearby the drilling location so as to reduce loss in drilling time.

A proper rebuilding of the joints involves welding new metal on the outer surface of both the pin member and box member of each joint to build up the wall thickness, dressing back the shoulders of each joint member to permit the pin to penetrate further into the box so as to eliminate the necessity of cutting new tapered threads on either the pin or box, and resurfacing the exterior of the two members after the wall thickening and re-shouldering processes.

My Patent No. 2,159,288, issued May 23, 1939, discloses and claims a mechanism for properly holding and re-shouldering the members of a tool joint, whether they be separate from or integral with sections of drill pipe, in a manner which assures that the newly cut shoulders will lie in planes which meet the longitudinal axis of the respective joint members or of the pipe sections, as the case may be, exactly at right angles. My Patent No. 2,159,287, also issued May 23, 1939, discloses and claims a means of centering the pipe joint members while the shoulders are being re-cut so as to assure the cutting of new shoulders which are exactly concentric to the longitudinal axis of the respective box and pin members.

Experience has taught that the extreme temperature to which the box is raised during the welding process (for increasing its wall thickness) sometimes so shrinks and generally distorts the shape of the box that its tapered threaded recess will no longer complementally receive the pin, even after the new shoulders have been cut to allow further penetration of the pin into the box.

It is, therefore, the chief object of the present invention to provide a tool which will preserve the original internal shape and configuration of the box members of tool joints during the wall thickening welding process, and thus prevent the necessity of re-cutting the tapered threads of the box, which re-cutting, as previously mentioned, is so difficult that it ordinarily necessitates sending the boxes to the factory, with consequent loss in drilling time.

The details in the construction of two preferred forms of my invention, together with other objects attending their production, will be better understood from the following description when read in connection with the accompanying drawing, which is chosen for illustrative purposes only, and in which

Figure 1 is a longitudinal sectional view, taken along the line 1—1 of Figure 2, of a composite tool showing one preferred form of the invention

in operative position inside a box member of a tool joint;

Figure 2 is a transverse sectional view of the tool illustrated in Figure 1, and is taken along the line 2—2 of that figure;

Figure 3 is a view similar to Figure 2, but is taken along the line 3—3 of Figure 1;

Figure 4 is a perspective view of another preferred form of the invention with one section of its shell removed to show details of construction; and

Figure 5 is a top plan view of the tool illustrated in Figure 4.

Like characters of reference designate identical parts in all figures of the drawing.

Before describing the invention, it might be well to state that the insertion of a solid plug into the box member before welding is not practical because the box member shrinks so much during the welding that it is impossible to remove the plug after the box walls have been allowed to cool.

The invention generally includes an elongated tapered exteriorly threaded shell made up of a plurality of elongated complemental sections, and a solid tapered pin for forcible insertion into said shell after the shell has been screwed into position in the box, said pin being adapted to expand said shell within said box to resist contraction and distortion of the box walls, and also being adapted for easy removal after the box walls have cooled.

Figures 1, 2 and 3, illustrate a form of the invention which is particularly adapted for use in rebuilding box members of comparatively small diameter, say from 2½" to 3½". The numerals 10, 11, and 12 designate complemental shell segments. These segments are preferably made originally from a solid steel slug which is heated to a high temperature and extruded into rough shape by hydraulic or other type press. The external surface of the shell is then cut to the same angle of taper as the recess in a standard box member (3" per foot taper) and is threaded. Next the interior surface of the shell is cut to a very slight taper, approximately ½" to ¾" per foot, as shown proportionately in the drawing, altho this latter taper may be varied within wider limits if desired. Since a complementally tapered pin 13 is to be used as a wedge, a greater expansive force may be exerted if a very slight taper is used. An exterior annular shoulder 14 is now milled in the large end of the shell, and it is then cut into a desired number of longitudinal segments, a small part of the shell being cut away with each longitudinal cut, so that the side edges of the various adjacent segments are spaced slightly apart when the segments are seated in a box 15. The dotted lines in Figure 1 represent one end of a section of drill pipe 16, which may be screwed into the box or made integral with it, as previously stated.

The pin 13, in addition to having an external taper to complementally fit the internal taper of the shell segments is provided at its large end with an integral concentric stud 17, the head of which is tapped with a hammer to drive the pin into the shell segments to expand the segments against the threaded interior surface of the box. A portion of the stud may be threaded, as at 18, to receive a spacing washer 19 and a nut 20, which may be tightened down on the washer 19 and used in connection with a long handled wrench in screwing the assembled segments into position in the box and in loosening and removing the pin from its seat after the wall thickening welding process has been completed and the box has cooled.

I provide a one-piece segment spacing ring 21 which snugly seats on the shoulder 14 of the complemental segments, 10, 11 and 12, and serves to relatively position and hold those segments in such position that the threads on each will match the threads of the box, thus facilitating the screwing of the assembled segments into the box after the preliminary insertion of the pin into the shell of segments. After the segments have screwed partially into the box 15, the ring 21 is removed to permit relative expansion of the segments as the pin 13 penetrates further into the tapered recess which they complementally form.

In the form of the invention illustrated in Figures 4 and 5, the main difference lies in the fact that the major portion of the interior surface of each of the segments, 10A, 11A, and 12A is in the form of a plane surface instead of being arcuate, as in the first embodiment described. The number of segments into which the shell is cut is immaterial so long as the pin 13A is formed with a corresponding number of substantially planar surface sides. The flat interior surface of each segment is formed with a centrally positioned longitudinally extending groove, these grooves being designated respectively by the numerals 22, 23, and 24. Each flat side of the pin 13A is provided with a centrally positioned longitudinally extending tongue, which tongues 25, 26 and 27, complementally and slidably fit in the respective grooves. The interior recess formed by the combined segments 10A, 11A, and 12A, is also a regularly tapered recess, and the pin 13A is complementally tapered to fit into that recess. The tongues and grooves simply serve to equiproportionately space the various segments within the box 15 and to cause them to move radially outward from the longitudinal axis of the pin as the pin is driven into the recess which they form. The segments 10A, 11A, and 12A are provided with a shoulder 14A which seats a spacing ring 21A. The pin 13A includes a stud 17A, threads 18A, a spacer washer 19A, and a nut 20A.

The main advantage of the latter embodiment is that it works better in repairing tool joints of larger diameter, say from 3½" or 4" up. The expansion of the segmentary shell is absolutely uniform and concentric to the original tapered recess in the box 15.

In using either embodiment of the tool the segments are assembled loosely and the segment spacing ring is placed in position on the shoulder 14 or 14A. The pin is then inserted into the segmentary shell to hold the segments against the inner surface of the spacing ring. The assembled unit is then screwed partially into the box until the threads are seated properly. The spacing ring is then removed from the top of the segments and the pin pushed snugly into its seat. The unit is then screwed tightly into the box and the pin is hammered into position. As the welding is done the pin is hammered farther into the shell and box. When the welding is completed and the box walls have cooled, the side of the pin and the side of the box are tapped lightly and the pin is easily withdrawn. The segments are then free to be removed and the threaded recess in the box remains exactly as it was before the welding was done.

While I have described and illustrated two specific embodiments of the invention, I am aware

that numerous alterations and changes may be made therein without transcending the invention conceived, and I do not wish to be limited except by the scope of the appended claims.

I claim:

1. A composite tool for maintaining the interior configuration of interiorly threaded tool joint boxes and the like during heat treatment and subsequent cooling of their walls comprising: a longitudinally sectioned substantially tubular shell exteriorly tapered and threaded to complementally screw into at least a portion of the tapered, threaded bore of a tool joint box, said shell having a longitudinal recess therein the cross sectional area of which decreases regularly from one of its ends to the other; and a pin shaped to complementally enter the recess in said shell, and adapted to expand the shell sections radially as it penetrates further into the shell recess.

2. A composite tool for maintaining the interior configuration of interiorly tapered and threaded tool joint boxes and the like during heat treatment and subsequent cooling of their walls comprising: a longitudinally sectioned substantially tubular shell exteriorly tapered and threaded to complementally screw into at least a portion of the tapered, threaded bore of a tool joint box, said shell having a longitudinal recess therein the cross sectional area of which decreases regularly from one of its ends to the other; a pin shaped to complementally enter the recess in said shell, and adapted to expand the shell sections radially as it penetrates further into the shell recess; and longitudinally extending complemental tongues and grooves on the exterior surface of said pin and the interior surface of each shell section for guiding the movement of the respective shell sections in a radial direction and for thus maintaining their relative spacing during the shell expansion.

3. A composite tool for preventing distortion of an interiorly threaded body during heating and subsequent cooling of its wall comprising: a longitudinally sectioned substantially tubular shell exteriorly threaded to screw into the threaded recess or bore in the body, said shell having a frusto-pyramidal longitudinally extending recess therein for receiving a wedge pin; and a frusto-pyramidal wedge pin complementally shaped to fit the recess in said shell and to expand the shell sections radially as the pin penetrates further into said recess.

4. A composite tool for preventing distortion of an interiorly threaded body during heating and subsequent cooling of the body wall comprising: a longitudinally sectioned substantially tubular shell exteriorly threaded to screw into the threaded recess or bore in the body, the interior surface of each of said sections being in the form of a plane surface, and the various interior surfaces of said sections together forming a frusto-pyramidal recess in said shell; a longitudinally extending groove cut into the interior surface of each of said shell sections, said groove having parallel side walls which are also parallel to a plane which cuts said shell radially; and a wedge pin complementally shaped to fit the recess formed by the assembled shell sections, and adapted to expand the shell sections radially as it penetrates into said recess.

FRANK MORGAN.