

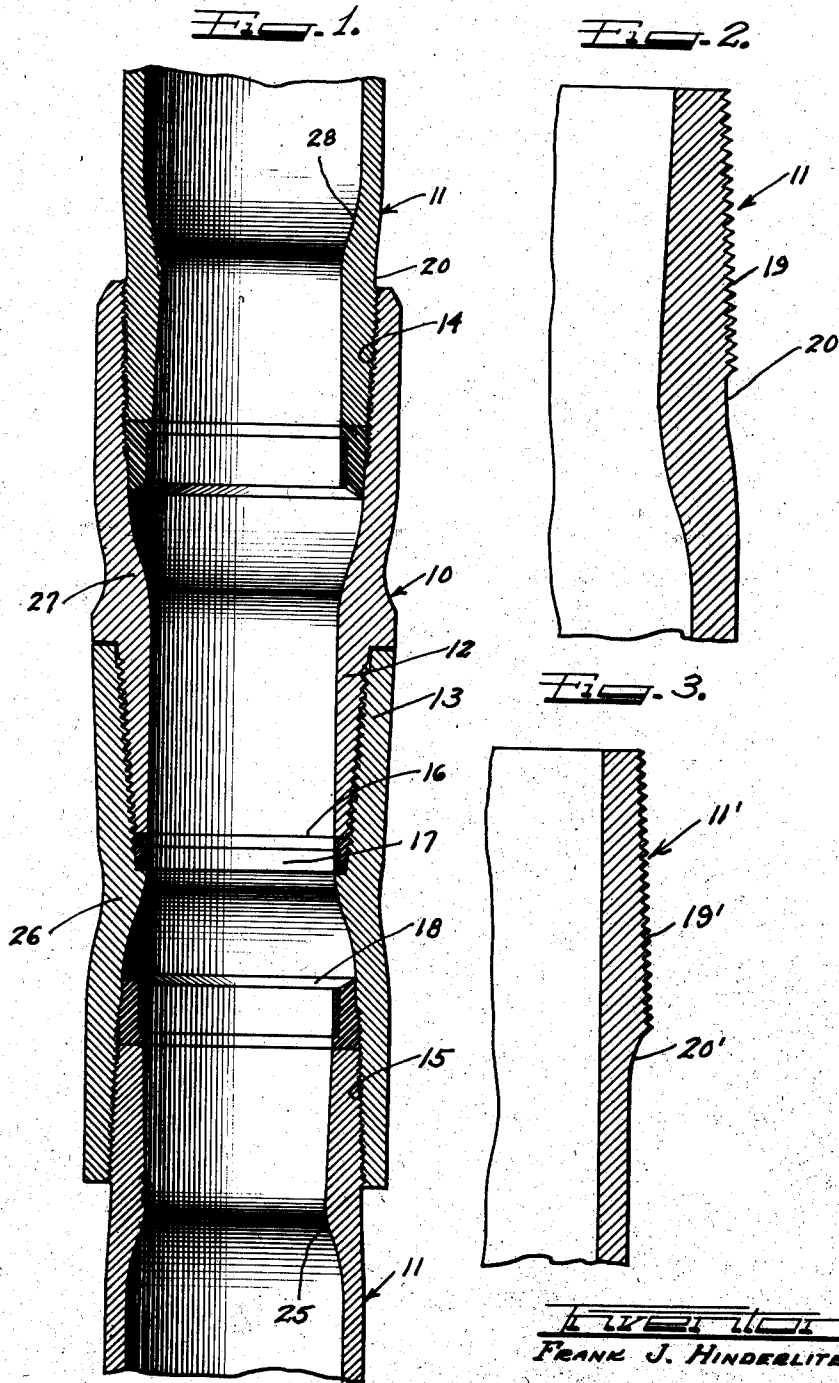
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F. J. HINDERLITER

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UPSET PIPE JOINT

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FRANK J. HINDERLITER.

Charles J. Hinderliter

Att. 5.

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UPSET PIPE JOINT

Frank J. Hinderliter, Tulsa, Okla.

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1 Claim. (Cl. 285—146)

This invention relates to a joint for well pipe, and more particularly to an upset pipe joint of the so-called rotary type.

An object of this invention is to provide an improved joint for connecting upset well pipe.

Another object of this invention is to provide the upset threaded joint end of pipe with a construction of such character that breakage due to excessive bending or stress in the manipulation of the pipe in a well is greatly minimized.

A still further object of the invention is to provide a joint for well pipe of such formation that its friction or surface contact with the wall of a well is greatly reduced, as well as its weight, so that excessive bending is also substantially reduced.

In accordance with the general features of this invention, there is provided a string of drill pipe connected by joints characterized by the upset threaded end of a pipe in the joint being tapered and having substantially full depth threads throughout its length; the outer wall of the upset end being slightly recessed or relieved beyond the joint connected to the end and adjacent the last full thread of the upset end to an extent sufficient so that the full thread leads and opens directly into the recess, whereby the upset end is not weakened by thread scratches or partial threads beyond the joint.

Another feature of this invention is to provide construction of the foregoing type for both so-called "external flush" and "internal flush" upset pipe.

Another and further feature of the invention relates to the provision of a well pipe joint, of the type including pipe sockets on its opposite ends, having spaced annular recesses in its wall between the pipe sockets of such arrangement as not to reduce the thickness of the joint wall at any point to a size less than the normal thickness of the walls of the connected pipe, whereby such recesses reduce the overall surface contact between the joint and the bore of a well, as well as reduce substantially the weight of the joint and thereby aid in preventing excessive bending due to the so-called whipping action of a pipe in a well.

Other objects and features of this invention will more fully appear from the following detailed description taken in connection with the accompanying drawing which illustrates several embodiments thereof, and in which:

Figure 1 is a vertical cross sectional view through a portion of a string of pipe including a

joint and two pipe ends connected thereto and embodying the features of this invention;

Figure 2 is an enlarged fragmentary view in section of a portion of the upset end of one of the pipes illustrated in Figure 1, showing my invention applied to a so-called "external flush" type of upset pipe; and

Figure 3 is a sectional view similar to Figure 2 illustrating the application of my invention to a so-called "internal flush" type of upset pipe.

The reference character 10 designates generally a so-called "Hinderliter" rotary pack-off type of joint to which my present invention is illustrated as being applied. This joint, as is well known in the trade, includes a pin part 12 and a box part 13, as well as two pipe sockets 14 and 15 at opposite ends of the joint. It is, of course, to be understood that while I have illustrated my invention as being applied to a rotary pack-off type of joint, my invention may be used with equal advantage in other types of joints now available for connecting well pipe together in a string of rotary pipe. My invention, however, is directed to meeting conditions and problems arising by reason of bending stresses, frictional wear, and heat conditions ensuing from the rotation of a length of pipe in a well.

It will be noted from Figure 1 that the pin end 12 of the joint is threaded in the usual way into the socket 13 and that the rubber sealing ring 16 is disposed at the bottom of the socket between the socket 13 and that a rubber sealing ring 16 this point as is fully covered in my previously issued Letters Patent. This rubber ring 16 has a reinforcing metallic ring 17.

In the embodiment of the invention illustrated in Figures 1 and 2, I have illustrated upset pipe 11 of the so-called "external flush" type, to which my invention has been applied. The two pipes fragmentarily illustrated in Figure 1 are identical, and hence a description of one will suffice for both.

This pipe 11 is referred to as an "external flush" upset type for the reason that the upset extends inwardly into the bore of the pipe rather than outwardly, so that the external surface of the pipe is substantially flush.

Each of the pipe sockets 14 and 15 is provided with a reinforced rubber sealing ring 18, which is disposed at the bottom of the socket and is compressed into sealing position by the inserting thrust of the upset pipe end threaded into the socket.

In accordance with the features of my invention, the external surface of this external flush

type of upset end pipe is provided adjacent the threads 19 with a recess or undercut 20. This undercut 20 it will be perceived is on substantially the same slant as that of the threads, and extends to a length of approximately $\frac{1}{8}$ " which is the length of the overhang portion at the drill pipe ends of A. P. I. standard tool joint structures. By reason of this undercut or recess, it is possible to provide full depth threads for the entire length of the threaded portion of the upset end of the pipe. This is a distinct advantage, since it eliminates weak portions in the threaded area where bending stresses are apt to concentrate and result in sheering or breaking of the pipe.

As noted, this arrangement enables all of the threads on the threaded end to be perfect threads as distinguished from the present practice wherein a portion of threads are not full depth or perfect threads. As an illustration, according to present A. P. I. standards for $6\frac{5}{8}$ " drill pipe, the total length of perfect threads thereon is 3.287" and the length of imperfect and vanishing threads thereon is 0.588". By employing my invention in such upset pipe, the total length of perfect threads is increased to the full length, namely, 3.875", and there are no imperfect or vanishing threads whatever thereon. As a consequence, my invention enables an increase of approximately 15% in the number of threads available for complete engagement with threads in the drill pipe end socket of a $6\frac{5}{8}$ " tool joint. Likewise, since there are no threads exposed or unengageable after a structure embodying my invention is completely assembled, breaking of the pipe at the drill pipe thread end due to corrosion or so-called notch fatigue will be substantially eliminated.

In Figure 3, I have illustrated a modification of my invention wherein the invention is applied to so-called "internal flush" type upset pipe. In this embodiment, the upset threaded end of the pipe 11' is provided adjacent the tapered apron or inclined thread 18' with a recess or fillet 20' in the external surface of the pipe. This curved fillet or notch extends for a distance beginning at the root of the last full thread of the thread 18' and extends at a predetermined angle toward the axis of the drill pipe until the diameter of said undercut or recess approximates the outside diameter of the drill pipe. In this embodiment, there is likewise no imperfect or vanishing threads on the drill pipe threaded end. Hence, the threaded end may be screwed into the socket of the joint so completely that there will be no threads remaining exposed or any partial threads or so-called thread notches which would be subjected to either corrosion or bending fatigue.

Also, by using my present invention, the common expedient of welding the threaded connection of a drill pipe to a tool joint is not necessary. Then, too, a much shorter upset, either external, internal, or both, is possible on the drill pipe threaded ends. Thus, the total weight of the complete string of upset drill pipe is substantially reduced or to an extent of at least as great as 6%.

It is, of course, well known that long upsets are difficult to form on pipe ends, because such upsets require several reheatings of the pipe ends to complete them. Needless to say, such reheating and subsequent frequent hammering cause serious impairment of the metallurgical structure of the upsets which tends to weaken long upsets very materially.

By the use of my invention, only one heating and one upsetting operation are required for the formation of a complete upset sufficiently long to permit the later formation of the required number of threads and the desired undercut on the upset.

In addition to the foregoing, I have found that in a string of rotary pipe equipped with my invention the bending stresses are equalized to a greater extent along the entire string, and the intense vibrations normally set up in the string while drilling are substantially dampened or neutralized by the aid of the plurality of resilient packings in each of the tool joints thereof.

Another feature of my present invention relates to the recessing of the walls of the tool joint and the curving of the same, as well as the ends of the pipe threaded therein, so as to reduce substantially the thickness or weight of the joint, as well as its available external contact area. This feature of my invention is accomplished by recessing and curving the walls of the parts of the joint and the pipe ends at a plurality of points as designated by the reference numerals 25, 26, 27, and 28. This recessing or curving of the walls of the pipe structure is of such character and extent that the ensuing structure will have a thickness closely approximating the normal thickness of the pipe wall. At least the decrease in the thickness of the wall of the joint parts should not be to such an extent as to cause the walls thereof to have a thickness less than the thickness of the pipe wall.

By thus reducing the thickness of the walls of the joint and pipe parts in a string of pipe, I am enabled to reduce materially the weight of the joints or connections between the pipe ends, which I have found to be distinctly advantageous from the standpoint of minimizing the wear and tear on the joint, as well as reducing to a minimum the likelihood of the bending stresses or whip action of the string of pipe causing a fracture in the joint area. In other words, a string of pipe rotating in a well, which is necessarily not perfectly true or vertical, will have what is commonly referred to as a whip action. Accordingly, any substantial increase in the weight of any portion of the string which is being subjected to such whipping or bending action results in a concentration of such whip or bending forces on the weightier areas. This point may be illustrated by tying a knot in the end portion of a whip and then whipping the whip. It will be found that the forces set up by the whip action will be concentrated at or on the knot portion and may quite likely result in a breaking of the whip at the knotted portion.

A similar action takes place in a rotating string of drill pipe in a well. Hence, it will be appreciated that by reducing the weight of the joint areas of the string, it is feasible to reduce at such areas the likelihood of the whip or bending stresses of the string of pipe severing or breaking the string at such joint areas.

Another advantage of my invention resides in the fact that the curved recesses in the external surfaces of the parts of the tool joint result in less contact between the external surface of the joint and the bore of the well. As a consequence, there is less abrading action on the joint as the string of pipe is rotated and the wear and tear on the joint is substantially reduced.

I claim as my invention:

In a string of tubular members or oil well pipe comprising a plurality of pipe sections connect-

able and disconnectable from each other by spaced joints which joints include internally threaded pipe end sockets in each of which is screwed an end of a pipe section, said pipe section end comprising an upset portion of substantially greater thickness than the normal thickness of the wall of the pipe and being externally threaded with a screw thread of a length to extend wholly within the corresponding thread of the socket and terminating in a threadless recessed portion in the outer surface of the pipe

wall at the outer extremity of the pipe socket and which recessed portion connects said upset threaded portion to the main body of the pipe, the thickness of the pipe wall of said recessed portion being greater than the normal pipe wall thickness and less than the thickness of the upset portion at the last thread thereon, whereby in the use of the pipe under stress the tendency for breakage to occur in the vicinity of said last thread is minimized.

FRANK J. HINDERLITER.