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METHOD OF REMOVING PIPE FROM WELLS

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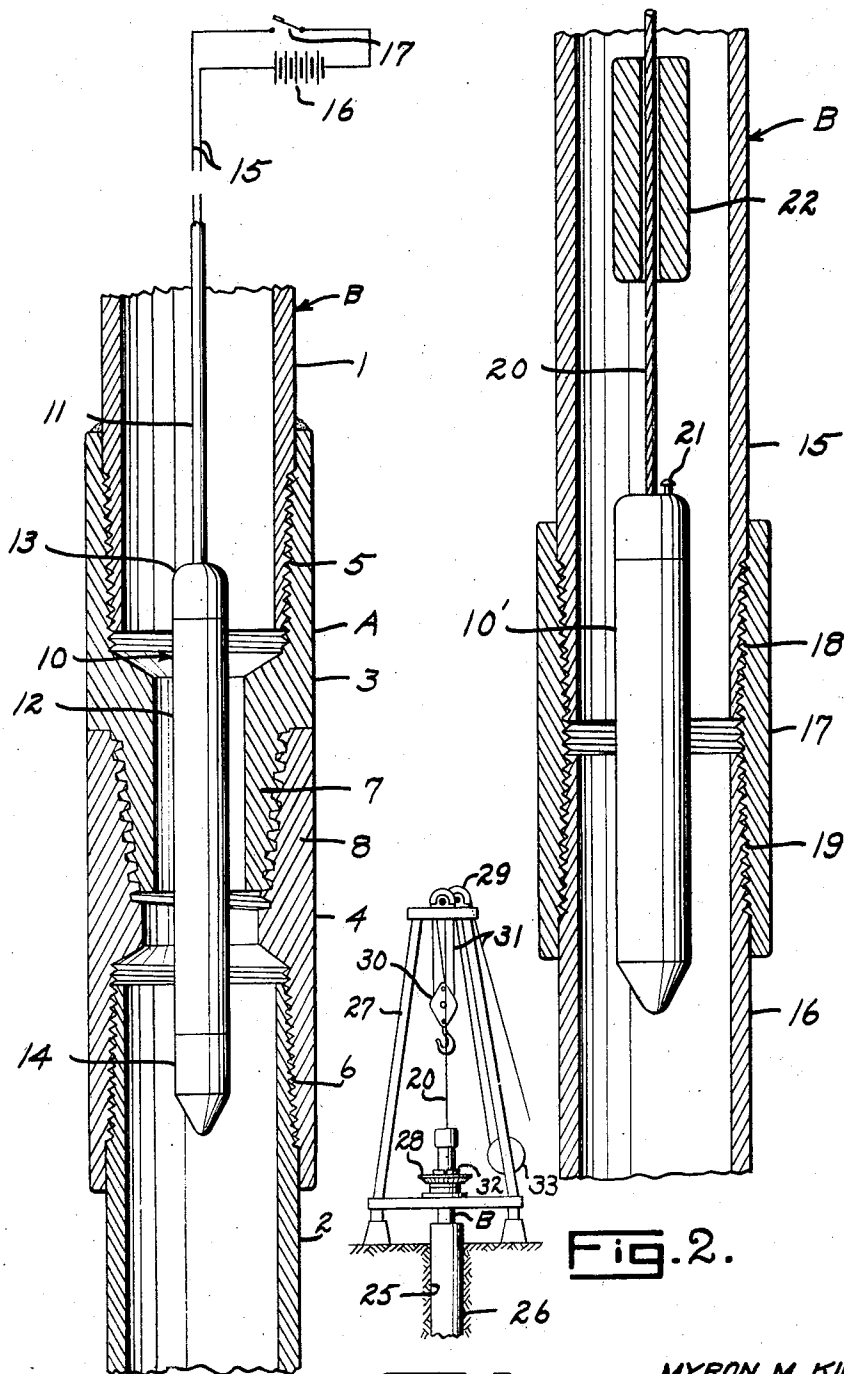


Fig. 1.

Fig. 3.

Fig. 2.

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METHOD OF REMOVING PIPE FROM WELLS

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2 Claims. (Cl. 255—1.8)

This invention relates to a method of releasing threaded sections of a string of pipe stuck within a well bore so that a portion of the string of pipe may be retrieved from the well bore for reuse.

In the drilling of wells by means of the rotary method it frequently happens that the drill string or pipe becomes stuck in the hole as by caving, heaving, sedimentation, etc. In such event it is desirable to recover as much of the drill string as possible. It is also frequently desirable to disconnect a threaded connection between sections of a tubing string or casing which has been cemented in a well or which becomes stuck and can not be withdrawn as an entire string by lifting thereon at the mouth of the well bore.

It has been proposed to rotate a stuck string in a direction to effect unthreading of a joint in such string. Such procedure is very unsatisfactory inasmuch as the location of the disconnect is indefinite and may release, if at all, only a short section of the string of which recovery is desired.

Since the joints of the string are always made up very tightly, this technique may result merely in twisting off of the string instead of unthreading of a joint and in this manner there are added difficulties to the problem of recovery of the string.

It has also been proposed to utilize cutting tools which may be lowered within the well bore and operated to sever the stuck string at some level within the bore and to thereafter withdraw that portion of the string which has been so severed from the lower or stuck portion of the string. Such procedure, however, requires the use of complicated cutting tools which are expensive and which introduce certain difficulties in their use.

It is the primary object of the present invention to provide a novel method of disconnecting, at a predetermined level in the well bore, a threaded connection between sections of a string of pipe stuck in the bore.

More specifically the present invention contemplates unthreading a connection in a string of pipe by applying a torque to such string tending to unthread a connection and subjecting a predetermined connection to a sudden jar whereby such particular connection is released.

Another object is to unthread a connection after such connection is relieved of part or all of the weight of the superposed portion of the pipe string.

A further object is to provide the desired jar

or impact by discharging an explosive proximate the connection to be unthreaded.

Still another object is to utilize an explosive jar to initiate unthreading of a desired connection or coupling, such jar being so constructed and containing such an explosive charge that none of the fibers in the material of the pipe string will be stressed beyond their elastic limit.

The foregoing objects together with other objects will be more fully apparent from the following description taken in connection with the accompanying drawing in which:

Fig. 1 is a sectional view through a drill pipe connection, an explosive jar being shown in position within such connection;

Fig. 2 is a sectional view showing an alternative embodiment of the explosive jar, such jar being shown in position within a coupling in a tubing string.

Fig. 3 is an assembly view showing the manner of applying torque to a drill string or other string of tubing to be disconnected within the well.

In Fig. 1 there is shown the usual type of connection A between successive sections 1 and 2 of a drill string or drill pipe B used in the rotary method of drilling wells. The construction shown comprises the pipe sections 1 and 2 which are connected to pin and box members 3 and 4 by means of pipe threads 5 and 6.

The pin 7 on the pin member 3 is provided with tapered threads which are complementary to those provided in the box 8 of the box member 4 as is well known in the art. As is also well known each of the threaded connections just described is made up very tightly in order that there will be no possibility of a disconnect or leak in the drill stem during normal drilling operations.

Positioned within the connection between the members 1 and 2 is an explosive jar generally referred to as 10 which is lowered within the tubing string by means of a conductor cable 11. The unit 10 comprises the housing 12 having cap members 13 and 14. The conductor cable 11 enters the cap member 13 and is provided with conventional means for discharging an explosive contained within the unit when a current is passed through the conductors 15 from the battery 16 by closure of the contact switch 17. The exact construction of the unit 10 is unimportant in the disclosure of the invention as the principal requirement is that the impact produced by the discharge thereof shall be sufficient to initiate unthreading of the connection A but insufficient to stress fibers of the sections 1 and 2 or

the pin and box members 3 and 4 beyond the elastic limit.

In the embodiment shown in Fig. 2 the string of pipe B comprises the pipe sections 15 and 16 which are interconnected by means of the coupling member 17 having its opposite ends threaded at 18 and 19 to engage complementary threads on the sections 15 and 16.

The explosive unit 10' shown in this figure is lowered upon a steel cable 20 and such unit is provided with a firing pin 21 to be engaged by an annular sinker or weight member 22 which is dropped within the tubing string after the unit 10' has been lowered to the desired position and the desired torque tending to unscrew the connection has been applied at the mouth of the well bore.

Fig. 3 schematically shows the equipment utilized for producing a disconnect of a connection in the drill or pipe string B within the well bore 25 which is provided with a casing 26 within which the drill stem is stuck. The string B extends upwardly through the floor of the derrick 27 and through the rotary table 28 mounted thereon.

The cable 20 passes upwardly from within the drill stem B and over a sheave 29 and thence to a suitable drum (not shown). When the explosive charge is to be discharged as illustrated in Fig. 2 the weight 22 is retained at the mouth of the well bore until the desired time for producing the releasing impact within the well. When, however, the explosive charge is to be electrically discharged as indicated in Fig. 1, the conductor cable 11 is used. As already pointed out this cable includes the conductors 15 and current is supplied to these conductors as by means of a conventional slip ring connection at the reeling drum from which the cable is unwound when lowering the unit 10 into the well. It is to be understood that, if desired, a grounded electric circuit may be used and in such event it is necessary to provide but a single insulated conductor in the cable 11.

In the operational steps for carrying out the invention any suitable elevator means may be attached to the drill string B to which a lifting force is applied by means of the traveling block 30 when the cable 31 is wound upon the cable drum 33 as is well known in the art. Cable is wound upon the drum 33 in such amount that the pipe string B is lifted to relieve the connection in the well of the weight of the superposed string. Slips 32 are then placed in the rotary

table 28 to hold the pipe string in such condition.

The rotary table 28 is then rotated, usually in a counterclockwise direction, to place a torque upon the stuck string of pipe within the well. The unit 10 has previously been lowered within the string B or may then be lowered to position as illustrated in either of Figs. 1 or 2. The switch 17 is then closed if a conductor cable 11 is used or the weight 22 is dropped at the mouth of the well if the cable 20 is used. In this manner the explosive within the unit 10 is discharged whereby such impact is applied to the coupling proximate the unit that a break in the interconnecting threads occurs. If the torque in the tubing string is insufficient to completely effect the disconnect, the rotary table 28 is rotated an additional amount until the disconnection is complete. Thereafter the sections of tubing string may be withdrawn from the well bore in the manner well known in the art.

It seems apparent that modifications of the invention above described will be apparent to those skilled in the art without departing from the spirit of the invention. Broadly the invention comprehends a novel method of disconnecting a threaded connection between sections of a tubular string of pipe stuck within a well bore by applying torque to the tubing string at its upper end and thereafter applying an impact to the particular connection which is to be disconnected.

What is claimed is:

1. The method of disconnecting a threaded connection between sections of a string of tubing or drill pipe stuck in a well comprising the steps of, applying a lifting force upon the string to reduce the stress applied to the connection by the weight of the superposed string, imparting to the upper portion of the string a torque tending to unthread the connection, and discharging at a point proximate the connection and interiorly thereof an explosive charge to initiate unthreading of the connection.

2. The method of disconnecting a threaded connection between sections of a string of tubing or drill pipe stuck within a well bore comprising the steps of lowering within the string an explosive charge to a point proximate the connection to be released, imparting to the string above such connection a torque tending to unthread the connection, and discharging said explosive to loosen the threaded connection.

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