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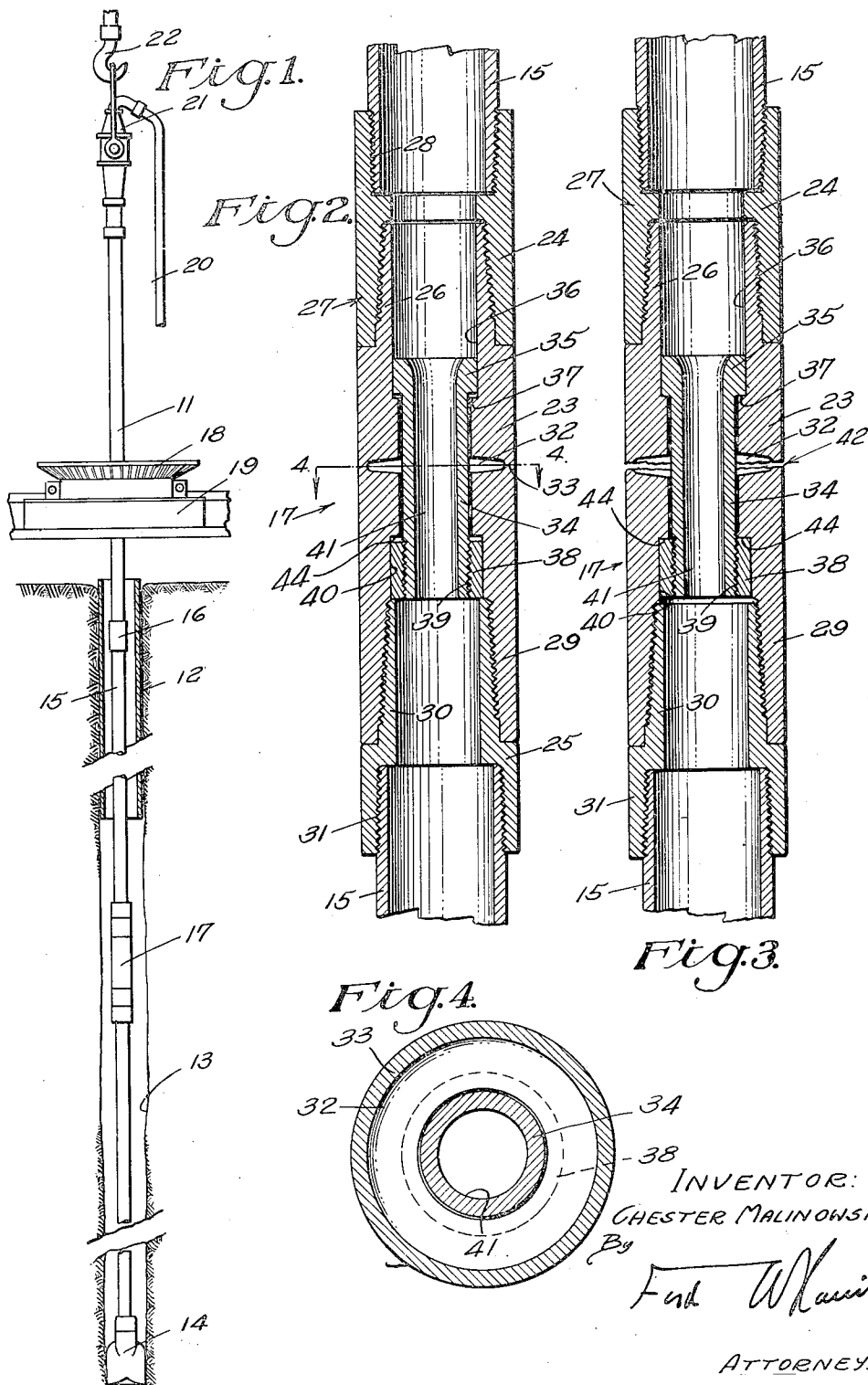
C. MALINOWSKI

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TWIST-OFF SAFETY COUPLING

Filed June 17, 1929

2 Sheets-Sheet 1



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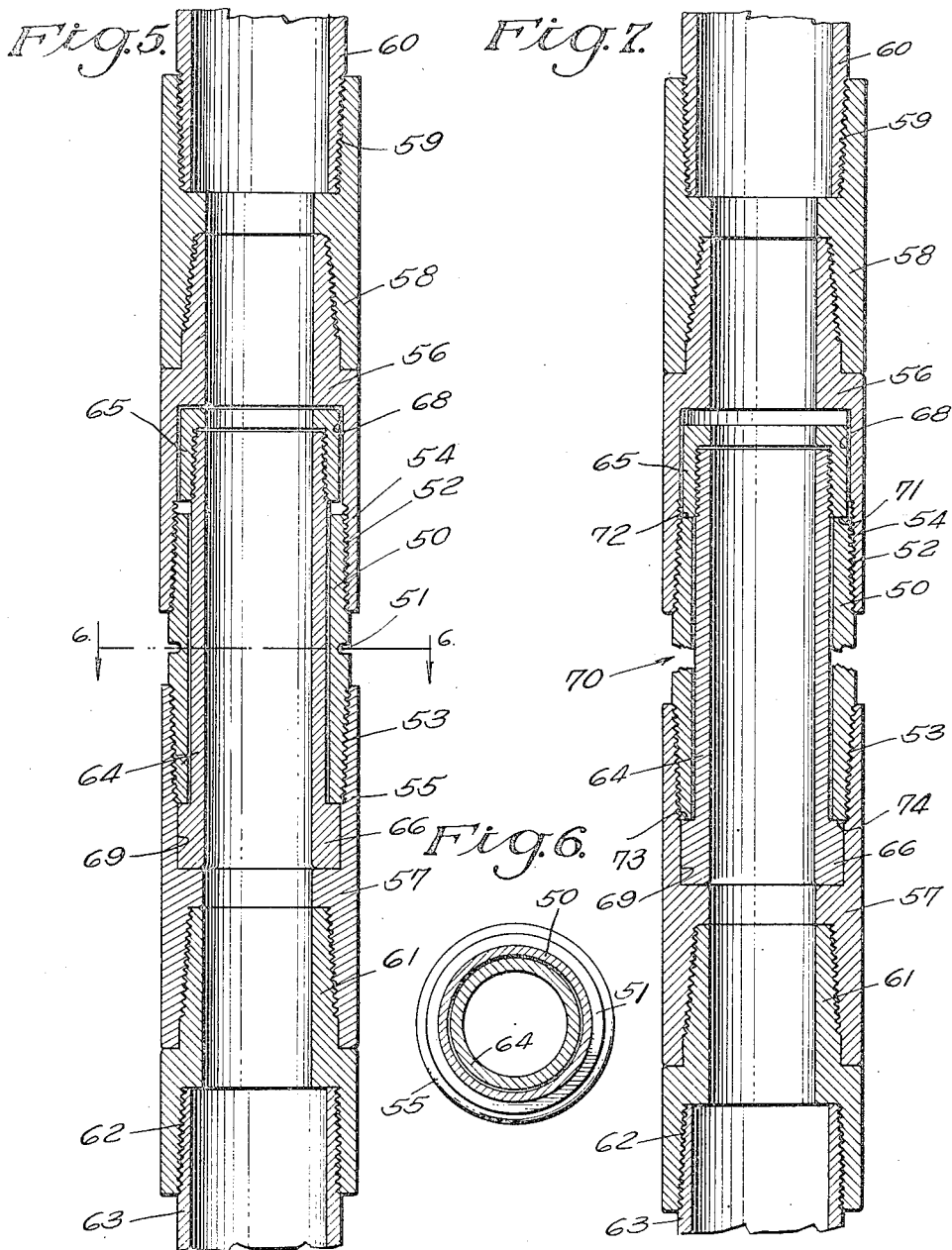
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TWIST-OFF SAFETY COUPLING

Application filed June 17, 1929. Serial No. 371,368.

This invention relates to a device for preventing loss of drill pipe in the operation of well drilling due to breaking off or twisting off of the drill pipe during the drilling operation.

In the rotary method of drilling wells great loss often occurs due to twisting off of the drill pipe at an intermediate point owing to the fact that it is sometimes impossible to remove the portion of the drill pipe below the point of breakage so that it becomes necessary to abandon the hole or side-track. The theory ordinarily advanced that such twist-offs are caused by excessive rotating torque applied to the upper end of the drill pipe by the rotary mechanism is apparently fallacious in view of the fact that greater than 200 H. P. would have to be applied to the ordinary drill pipe to cause its breakage purely by torque, whereas ordinarily only 100 H. P. is available at the rotary table.

The actual cause of twist-offs is due to a combination of effects in which a principal factor is the constant reversing of flexure or bending back and forth of a string of drill pipe which is being operated within a hole of larger diameter than such drill pipe. Due to the fatigue of the metal in the string of drill pipe as the result of the conditions under which it is operated, the ultimate strength thereof is gradually reduced until the resistance of the drill pipe against torque is no greater than the torque applied to the string of drill pipe by the rotary mechanism, and rupture naturally follows.

It appears that under the present methods of rotary drilling breakage of the drill pipe cannot be prevented. The present invention therefore comprehends a means for preventing loss of the portion of the drill pipe below the point at which the twist-off has occurred.

It is an object of the invention to provide a drill pipe having one or more definitely established points where twist-offs will occur before a condition conducive to rupture is reached in the remaining portions of the drill pipe, and having lifting means traversing the established point or points of rupture by which the portion of the drill pipe below a

point of rupture may be lifted by the part of the drill pipe above such point of rupture.

It is also an object of the invention to provide a twist-off loss preventer or safety device which may be incorporated in a string of drill pipe in such manner that the device will be subjected to all of the conditions of torque, flexure and fatigue imposed on the string of drill pipe, this device having resistance to the above-mentioned conditions of torque, flexure and fatigue which is less than the resistance of the remainder of the drill pipe to such conditions, thereby causing rupture to occur in the device in advance of rupture of the drill pipe.

It is a further object of the invention to provide a tubular member having coupling means at the end thereof whereby it may be incorporated in a string of drill pipe, this tubular member having an annular groove therein reducing the wall section of the tubular member to such an extent that rupture will occur thereat before conditions conducive to rupture in the drill pipe are approached, and having a lifting means in the form of an inner sleeve which longitudinally traverses the thus established point of rupture and engages above and below such point of rupture so that the lower portion of the drill pipe may be lifted by the upper portion and loss of the lower portions in the well being thereby prevented.

Further objects and advantages will be made evident throughout the following part of the specification.

Referring to the drawings which are for illustrative purposes only:

Fig. 1 is a diagrammatic elevational view showing the utility of the invention.

Fig. 2 is an enlarged vertical cross-section through my twist-off loss preventer.

Fig. 3 is a vertical section similar to Fig. 2 but illustrating the manner in which the lower portion of a string of drill pipe below the point of rupture is lifted by the upper part of the string of drill pipe.

Fig. 4 is an enlarged section on a plane represented by the line 4—4 of Fig. 2.

Fig. 5 is a vertical cross-section showing an alternative form of twist-off loss pre-

venter having a simple and easily replaced rupturable part.

Fig. 6 is a section on a plane represented by the line 6—6 of Fig. 5.

Fig. 7 is a sectional view similar to Fig. 5 showing the twist-off loss preventer after rupture has occurred and during the lifting of the lower part of the drill pipe from the well.

In Fig. 1, I show a string of drill pipe 11 extending through a well casing 12 and into the open or uncased portion 13 of a hole being drilled by a tool 14 situated at the lower end of the drill pipe 11 which consists of pipe sections 15 secured together by couplings 16, there being one or more twist-off loss preventers incorporated in the string of drill pipe 11 as indicated at 17. The drill pipe is rotated by means of a rotary table 18 forming part of a rotary apparatus 19, and during the drilling operation drilling mud is forced downwardly through the drill pipe 11 by means of a rotary hose 20 and a swivel connection 21 which is supported from the traveling block of the drilling rig by such means as indicated by a hook 22.

The twist-off loss preventer 17, as shown in Figs. 2 to 4 inclusive, may include a tubular member 23 having upper and lower coupling means 24 and 25. The coupling means 24 preferably includes a tool joint pin 26 which extends into a tool joint box 27 attached by threads 28 to the lower end of a pipe section 15, and the lower coupling means may conveniently consist of a female threaded portion 29 formed at the lower end of the tubular member 23 so as to receive a tool joint pin 30 which is screwed as indicated at 31 to the upper end of a pipe section 15.

Intermediately between the ends of the tubular member 23 an internal annular groove 32 is cut, thus reducing the thickness of the intermediate annular wall portion 33 of the tubular member 23 to such an extent that such annular wall portion 33 will be of less strength than the pipe sections 15 or the other members employed in making up the string of drill pipe such as couplings and tool joints. Extending within the tubular member 23 is a lifting means in the form of a sleeve 34 having an enlargement or flange 35 at the upper end thereof which resides in a counterbore 36 formed in the upper end of the tubular member 23 and is adapted to engage a shoulder 37. An enlargement 38 is provided at the lower end of the sleeve member 34, this enlargement consisting of a sleeve which may be secured by threads 39 and which resides within a counterbore 40 in the lower end of the tubular member 23. Rotary mud forced through the string of drill pipe passes through the axial opening 41 of the lifting sleeve 34. The tubular member 23 is so connected into the string of drill pipe that it is subjected to the same

stresses as the remaining portions of the string of drill pipe.

The rotating torque carried from the rotary table 18 to the drilling tool 14 must be transmitted through the wall portion 33. Strains due to constantly reversing flexure of the string of drill pipe are also placed on the annular wall 33 with the result that the same conditions of fatigue occur in the wall 33 as in the remaining portions of the drill pipe.

The various shock loads which are placed on the string of drill pipe are also exerted on the annular wall portion 33; therefore, this wall portion 33 being of less strength or of less resistance to the effects of the operating conditions will rupture before a condition conducive of rupture is reached in any other portion of the tubular drilling shaft which the pipe sections 15 and their coupling means form.

By use of the twist-off loss preventer the point of twist-off is definitely predetermined or established with the result that should twist-off occur during the drilling operation it will be confined to the wall portion 33 of the tubular member 23. In Fig. 3 a rupture 42 is indicated through the annular wall portion 33. When such rupture occurs the portion of the annular member 23 above the rupture may rotate freely on the upper portion of the sleeve member 34. The sudden release of load on the rotary table indicates to the operator that twist-off has occurred whereupon he may immediately stop the rotary table 18, and then by lifting the portion of the string of drill pipe above the rupture 42 may lift the portion of the drill pipe below the rupture 42 by means of the lifting sleeve 34, the enlargements 35 and 38 of which provide a means of interengagement with the shoulders 37 and 44 of the upper and lower portions of the sleeve member 23.

In Figs. 5, 6 and 7, I show an alternative form of my invention in which a rupturable member 50, having an external wall section reducing groove 51 therein, is equipped with male threads 52 and 53 on the ends thereof whereby it may be screwed into the female threaded portions 54 and 55 of coupling members 56 and 57, the coupling member 56 being adapted for engagement with a tool joint box 58 threaded at 59 to the lower end of a pipe section 60, and the coupling member 57 being adapted for attachment to a tool box pin 61 which is threaded at 62 to the upper end of a pipe section 63. In this form of the invention the lifting sleeve 64 extends entirely through the rupturable member 50 so that the enlargements 65 and 66 on the ends thereof reside in counterbores 68 and 69 in the respective coupling members 56 and 57.

When the upper portion of the string of drill pipe is lifted after rupture has occurred, as indicated at 70 in Fig. 7, the shoulder 71

of the enlargement 65 engages the upper annular end face 72 of the rupturable member 50, and the shoulder 73 of the lower enlargement 66 engages the lower annular end face 74 of the rupturable member 50, thereby enabling lifting of the lower portion of the drill pipe from the well by means of the upper portion of the drill pipe, thereby eliminating necessity for use of fishing tools and reducing to a minimum the possibility of loss of a portion of drill pipe in a well due to twist-off.

In both forms of my invention the same principles are embodied. The rupturable members 23 and 50 of the respective forms shown are both connected into the string of drill pipe in such manner that they will be subjected to the same conditions of stress, torque, flexure and fatigue as any other part of the drill pipe, and being equipped with a wall structure of relatively reduced strength or resistance to drilling conditions confine such twist-offs as may occur to predetermined points where separate interconnecting and lifting means are located.

I have illustrated and described practical and operative forms of my invention, but it is recognized that certain parts thereof are representative of other parts, elements or devices whereby equivalent results may be accomplished in substantially the same manner; therefore, the invention is not confined to the details herein disclosed but shall be accorded the scope of the following claims.

I claim as my invention:

1. A twist-off loss preventer of the character described, including: a tubular member adapted for placement in a string of drill pipe, such member being subjected to the same conditions of torque, flexure and fatigue as said string of drill pipe and being made with less strength than said drill pipe so as to rupture in advance of said string of drill pipe; and means whereby the part of said string of drill pipe below said member may be lifted by the part of said string of drill pipe above said member when said tubular member has been ruptured.

2. A twist-off loss preventer of the character described, including: a tubular member adapted for placement in a string of drill pipe, such member being subjected to the same conditions of torque, flexure and fatigue as said string of drill pipe and being made with less strength than said drill pipe so as to rupture in advance of said string of drill pipe; and means extending through said tubular member whereby the part of said string of drill pipe below said member may be lifted by the part of said string of drill pipe above said member when said tubular member has been ruptured.

3. A twist-off loss preventer of the character described, including: a tubular member adapted for placement in a string of drill

pipe, such member being subjected to the same conditions of torque, flexure and fatigue as said string of drill pipe and being made with less strength than said drill pipe so as to rupture in advance of said string of drill pipe; and an inner sleeve member extending within said tubular member and having engagement means whereby the part of said string of drill pipe below said member may be lifted by the part of said string of drill pipe above said member when said tubular member has been ruptured.

4. A twist-off loss preventer for use in a string of drill pipe, including: an upper coupling member; a lower coupling member; a rupturable member of less strength than said drill pipe extending between said coupling members, said rupturable member being rigidly secured to said coupling members so as to be subjected to the same stresses as said drill pipe and being made with such strength that it will rupture before the remaining parts of said string of drill pipe; and lifting means extending longitudinally with respect to said rupturable member.

5. A twist-off preventer for use in a string of drill pipe, including: an upper coupling member; a lower coupling member; a member having an established point of rupture of less strength than said drill pipe, said rupturable member extending between said coupling members and being rigidly secured thereto so as to be subjected to the same stresses as said drill pipe; and lifting means extending longitudinally with respect to said rupturable member, said lifting means including a tubular member extending within said rupturable member and having enlargements at its ends engaging above and below said point of rupture.

6. A twist-off loss preventer for use in a string of drill pipe, including: an upper coupling member; a lower coupling member; a rupturable member having an established point of rupture of such strength that rupture will occur at said established point before the rupture of the remaining parts of said string of drill pipe, said rupturable member being adapted to carry all loads transmitted between said coupling members; and a lifting means extending longitudinally with respect to said rupturable member whereby said lower coupling member may be lifted after rupture of said rupturable member.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 1st day of June, 1929.

CHESTER MALINOWSKI.