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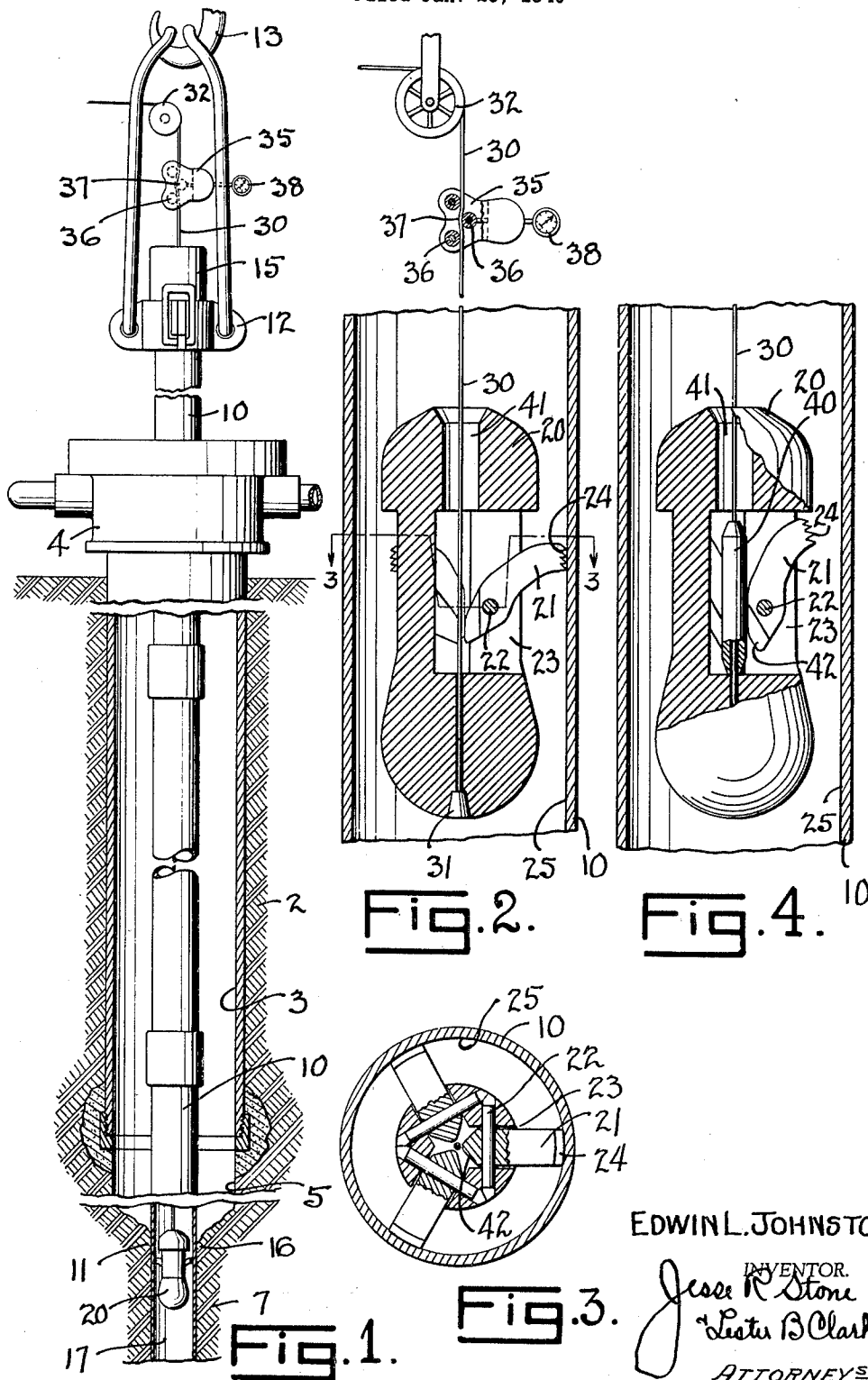
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METHOD OF LOCATING STUCK PIPE IN WELLS

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Sketches pipe section from point of sticking and point of pull unit. At origin of sticking there is no stick.

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METHOD OF LOCATING STUCK PIPE IN
WELLS

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2 Claims. (Cl. 73—51)

The invention relates to a method of locating the elevation at which the outer periphery of a pipe may be stuck in a well bore.

In the drilling of wells by the rotary method where drill stem, casing and tubing are lowered and raised in the well bore with very slight clearances between the outside diameter thereof and the diameter of the well bore, it quite frequently happens that due to the crookedness of the well bore, to the caving of the formation into the bore or for various reasons relating to the consistency of the drilling mud used in drilling a well, these various strings of pipe may become firmly lodged in the well bore. In some circumstances this pipe may become broken off or in the case of the drill pipe the bit or other parts of the pipe may become stuck or wedged in the well bore and the pipe twisted off.

In either event, whether the pipe is twisted off in the well bore or whether it extends to the surface, it is desirable to locate the elevation at which the sticking occurs. If the pipe is broken off a spear or grappling tool may be connected to the upper end thereof by means of an operating pipe and this operating pipe may extend to the surface. On the other hand if the pipe is not broken off but extends to the surface, then a hoisting mechanism may be connected to the pipe in either case and a pull exerted thereon. If the pipe is firmly lodged in position and cannot be pulled loose, it is then desired to locate the elevation at which it is stuck, either for the purpose of unscrewing the pipe which is not stuck and removing it or for salvaging or cutting operations to remove the stuck pipe.

The present invention therefore contemplates a method for determining the elevation at which the sticking occurs by taking advantage of the fact that when a substantial pull is exerted upon a long string of pipe, the material of the pipe will stretch, due to the pull. If the point of elevation at which no stretching occurs can be ascertained this point will, of course, substantially coincide with the point where the pipe is stuck and the present invention therefore contemplates that by practicing the method of the invention the elevation where there is no stretching can be located.

It is one of the objects of the invention to anchor a detector unit to the inside of a stuck pipe in a well bore and to then pull on the pipe to determine whether the pipe at the elevation of anchorage is stretching due to such pull.

Another object of the invention is to exert a pull upon a stuck pipe in a well bore and de-

termine the length of pipe which is stretching due to such pull so as to locate the elevation at which the pipe is stuck in the well.

Another object of the invention is to exert a simultaneous pull upon an anchoring device in a pipe and upon the pipe itself to determine whether the pipe moves at the elevation of anchorage.

Other and further objects of the invention will be readily apparent when the following description is considered in connection with the accompanying drawing in which:

Fig. 1 is a well bore containing a stuck pipe and illustrated in side sectional elevation with certain parts broken away to show the arrangement thereof.

Fig. 2 is a vertical sectional view of the anchoring device as it is lodged inside of the stuck pipe.

Fig. 3 is a section taken on the line 3—3 of Fig. 2.

Fig. 4 is a view in section of the device partly broken away as it is being moved in the pipe.

In Fig. 1 an earth formation 2 has been illustrated as having been drilled to receive a casing 3. This is usually designated as a surface casing and serves as an anchor for the well head 4. The well is then drilled into the formation as at 5 and the well bore remains open during the drilling and completing of the well. The well bore 5 is usually filled with a drilling fluid or mud which may be compounded with any desired specific gravity so that it will have a greater weight than the formation such as 7 which has been penetrated by the well bore. In this manner it is intended that the formation will not cave into the well bore because of the greater specific gravity of the drilling fluid. It is the rule rather than the exception that wells drilled by the rotary method are inclined or crooked and in many instances the drill pipe or other strings of pipe being lowered into the well bore or removed therefrom, become stuck in the well. Such a pipe is indicated generally at 10 and this pipe may be a drill stem, a string of casing, a tubing or any other string of pipe which is being positioned or manipulated in the well bore.

This pipe may become stuck due to various conditions, one of which is the composition of the drilling mud being circulated in the well bore. Sometimes the circulating equipment fails or for some reason circulation of the mud is discontinued and the more solid particles thereof settle in the well bore to become lodged about the pipe in the bore. In other instances the mud may have certain gelling qualities which would cause

it to become very viscous when circulation is discontinued. In other instances the formations such as 11 might cave in about the pipe and cause it to become lodged in the bore.

In any event if the pipe 10 becomes stuck in the well bore and cannot be removed by exerting a pull thereon, it is desirable to ascertain the elevation at which the pipe is stuck. The pipe may then be unscrewed, salvaged or worked upon to effect its release.

In some instances the pipe may be twisted off inside of the well and if this occurs a suitable grappling tool or spear may be connected thereto by means of an operating pipe. A pull can then be exerted on the operating pipe to attempt to remove the stuck pipe. In either event the pipe which is indicated generally at 10 may extend to the surface so that it may be anchored by an elevator 12 connected to a hoisting mechanism 13. In this manner a substantial pull may be exerted on the pipe to cause a stretching thereof between the upper end 15 and the point 16 where the pipe is stuck. Of course there will be no stretching of the pipe at the elevation 17 below the point where it is stuck so that the stretching of the pipe offers a definite means of ascertaining the elevation of sticking.

Figs. 2, 3 and 4 show a mechanism to be anchored inside of the pipe and to move therewith if the pipe stretches and to remain stationary if the pipe does not stretch. This mechanism comprises a body or unit 20 which may be of any desired shape or configuration and which carries a plurality of anchoring members or dogs 21 which are pivoted on cross shafts 22 in the body so that they may move laterally in the recesses 23. These members have their center of gravity radially outward from the pivots 22 so that they will normally drop outward as seen in Fig. 2. The outer ends thereof may have teeth 24 thereon to bite into the inner surface 25 of the pipe 10. This unit is manipulated by means of a wire line or cable 30 which is connected at 31 to the unit or body. It seems obvious that this device can be lowered into the well and thru the pipe 10 by lowering the cable 30. The dogs 21 will drag along on the inside of the pipe until such time as there is an upward movement of the unit when a pull is exerted on the cable 30. When this occurs the dogs will bite into the casing as seen in Fig. 2 so as to anchor the unit 20 at that elevation in the pipe.

A pull is in this manner exerted on the cable 30 which is illustrated as passing over a pulley 32 to a suitable reel whereby a pull may be maintained thereon. As the device is anchored in this manner it is shown as having been passed thru a recording or indicating device 35 which may be in the nature of a weight indicator which has three out of alignment contact members 36 so that a slight bend 37 is applied to the flexible line 30. The pull exerted on the line is indicated upon a gauge 38 and is proportional to the tendency of the bend 37 to be removed. In this manner any variation in a constant pull upon the cable 30 will be registered by the meter or gauge 38.

In operation the elevator 12 may be connected to the pipe, the unit 20 lowered into position and a pull exerted upon the cable 30 so as to anchor the unit in the pipe. The reading of the gauge 38 will be observed and a pull is now exerted on

the hoisting mechanism 13 so as to exert a pull on the pipe 10. It seems obvious that if the unit 20 is anchored at an elevation in the pipe 10 that is above the point 16 that any stretching of the pipe will tend to raise the unit 20 along with the pipe as it stretches. Raising of the unit 20 will reduce the tension on the cable or wire line 30 and cause a variation in the reading or recording of the gauge 38. If, however, the unit 20 is anchored to the pipe below the elevation of the point 16, as indicated in Fig. 1, then, of course, there will be no stretching of the pipe at that elevation and there will be no variation in the gauge 38. This will indicate to the operator that his unit is anchored below the elevation at which the pipe is stuck.

In practice it is likely that the unit 20 will be introduced into the top of the pipe 10 and a simultaneous pull exerted on the cable 30 and the hoisting mechanism at predetermined intervals or distances in the pipe. For instance if the elevation is not known at all, then the unit may be lowered at 10, 20, 50 or 100 feet distance and the pulls exerted to determine whether the point of sticking has been reached. The first time that there is no variation in the gauge 38 should indicate to the operator that he has passed the elevation at which the pipe is stuck.

Each time the device is anchored it can be released by merely slacking off on the wire line 30 due to the fact that the body 20 is a substantial mass and will cause the unit to move downwardly by gravity.

If the unit should be anchored below the point of sticking and it is desired that it be raised or if the point of sticking has been found and the unit is to be removed from the well, a go-devil or weight 40 may be passed over the line 30 to move by gravity downwardly along the line. As this weight reaches the unit 20 it will pass in the opening 41 and contact the heel portions 42 on the dogs or jaws 21 to move them to retracted position as seen in Fig. 4. This will be particularly effective if the unit 20 is lowered somewhat as the weight 40 engages the dogs. The dogs or anchoring members are thus completely retracted and the unit may be withdrawn from the pipe.

The information thus obtained as to the elevation of the sticking of the pipe can be used in the salvaging or removing of the stuck pipe.

What is claimed is:

1. A method of locating the elevation of the sticking of a pipe in a well bore which comprises anchoring an indicator line to the pipe successively at various elevations therein, and exerting a pull on the pipe so as to stretch the pipe between the point of pulling and the points of sticking while the indicator line is anchored to the pipe, and determining the elevation of the point of sticking as substantially the highest elevation at which there is no movement of the indicator line upon the exertion of said pull.

2. A method of locating the elevation of sticking of a pipe in a well bore which comprises anchoring an end portion of a wire line inside of the stuck pipe at a known elevation and above the elevation of sticking, exerting a pull on the pipe to stretch it above the point of sticking, and determining the movement of each the wire line and the pipe as an indication of the elevation at which the pipe is sticking.

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