

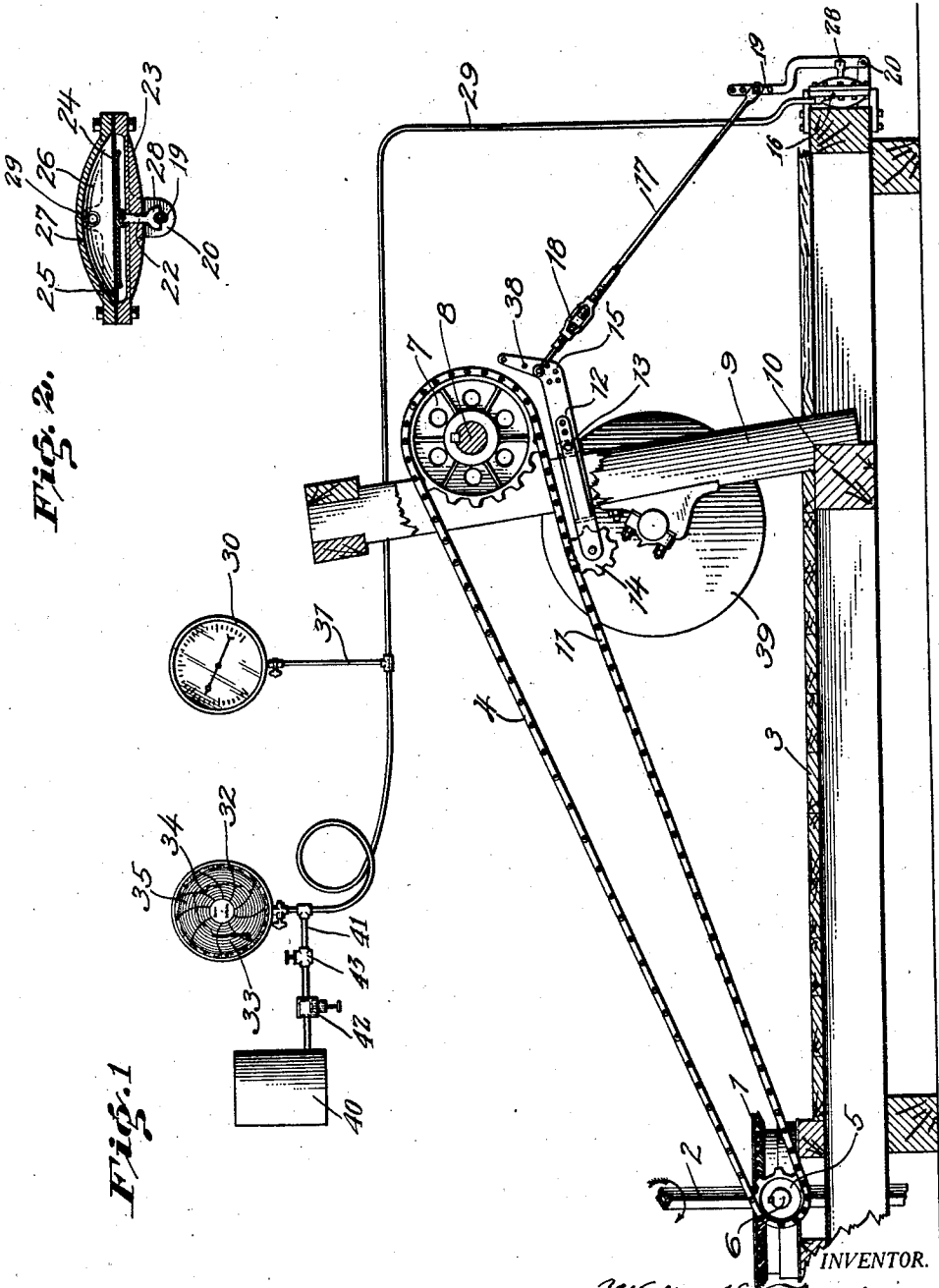
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TORQUE INDICATING APPARATUS

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TORQUE-INDICATING APPARATUS

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This invention relates to well drilling apparatus of the rotary type. In rotating drilling strings with rotary table, twist-offs of the drill collars sometimes occur, and it is very desirable, if possible, to have some means of indicating approximately what degree of torque is being developed in the drill collar. The general object of this invention is to provide a simple device for indicating approximately what the torque is in such a drill string and to provide a record of the same throughout the drilling period. One of the principal objects of the invention is to provide means for mounting the torque indicating apparatus so that it will be out of the way and not encumber the space between the drawworks and the derrick floor; in other words, to provide a simple construction for such mechanism as will enable it to be placed at one side where it will not interfere with the regular operation of the driving chain.

In its preferred embodiment the invention includes a rock-frame or lever carrying a sprocket engaging the tight side of the driving chain that rotates the rotary table, and one of the objects of the invention is to provide simple means for translating movements of this rock-frame to hydraulic indicating apparatus in such a way that a very slight increase in tension in the sprocket chain will be indicated by a corresponding increase in pressure in the liquid in the hydraulic apparatus, and vice versa.

Further objects of the invention will appear hereinafter.

The invention consists in the novel parts and combination of parts to be described hereinafter, all of which contribute to produce an efficient torque indicating apparatus.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawing:

Figure 1 is a view of a diagrammatic nature showing the derrick floor in vertical section and indicating a driving chain connected with a rotary table. The view also illustrates an embodiment of my torque indicating apparatus.

Figure 2 is a section through the pressure device taken in a plane parallel with the plane of projection of Figure 1, but upon an enlarged scale, and further illustrating details of the pressure device, the control of which controls the indicating device in the hydraulic system.

Referring more particularly to the parts, 1 represents a rotary table of any suitable construction, through which a kelly 2 passes in the usual manner, the said kelly being connected below to a drill string, not illustrated. This rotary table 1 is mounted on a derrick floor 3 and driven by an endless sprocket chain 4, said chain passing over a driven sprocket wheel 5 on a countershaft 6 that drives the rotary table 1 through the usual beveled pinion, not illustrated.

In the present instance the sprocket chain 4 is driven by a large sprocket wheel 7 carried on a horizontal shaft 8 mounted on the side of a fixed frame 9 fixed to the frame work of the derrick or secured to floor beams 10 of the derrick floor. In other words, this frame 9 is held in a rigid position.

In applying our invention, we provide a rock-frame which is preferably supported on the fixed frame 9, and this frame is provided with a sprocket wheel that engages the tight side or tight run 11 of the chain and displaces the same from a straight line. It will be evident that as the torque increases at the kelly 2, the tension in the tight side 11 of the chain will likewise increase and this will increase the force that the tight side 11 of the chain would exert upon the sprocket wheel.

The rock-frame is preferably in the form of a lever 12 mounted on a fixed pivot 13 on the frame at its outer side, the body of the lever projecting toward the rotary table and carrying a sprocket wheel 14 to engage the under side of the run 11 of the chain.

The outer arm 15 of this lever 12 is connected by suitable means with a hydraulic pressure device 16. The connection between the lever 12 and the hydraulic pressure device is such that the lever 12, through the agency of the force exerted on it by the run 11,

will maintain pressure in the hydraulic pressure device.

In order to accomplish this in a simple manner, the arm 15 of the rock-frame or lever 12 has connected to it a tension member 17 in the form of a link, preferably including a turn-buckle 18. The lower end of this link is attached to a lever 19 having its fulcrum at 20 and pressing against the diaphragm of the pressure device.

The hydraulic pressure device may be of any suitable construction, but should include a plunger 22 that projects outwardly and slides freely through one of the sections 23 of the casing of the pressure device. The inner end of this plunger or stem is connected to a large pressure plate 24 that thrusts against the side of a diaphragm 25, said diaphragm operating to close a pressure chamber 26 between it and the curved or dished section 27 of the device. If desired, the stem or plunger 22 may be provided with a bifurcated or saddle-shaped head 28 that engages the side of the link. The pressure chamber 26 is connected by a suitable pipe 29 with suitable indicating or recording apparatus for showing changes in pressure in the liquid that fills the pressure device 16 and the hydraulic apparatus connected therewith.

In practice we prefer to provide an ordinary pressure indicator 30 connected by an upright pipe 31 with the pipe 29 and, if desired, a clock-driven recording instrument 32 may be connected with the end of the pipe 29, said instrument including a recording pin 33 that scribes a record or line 34 on a rotating dial 35. This dial is driven by a clock. The scribing arm 33 is controlled by the pressure as is usual in pressure recording instruments of this type. In this way, the line 34 will be found to indicate the varying torque stresses in the drill string actuated by the kelly.

The turn-buckle 18 is useful in adjusting the tension in the length of the link 17, and in addition to this, if desired, a plurality of different openings 38 may be provided in the lever 15 to enable the upper end of this link to be attached in different positions giving more or less leverage to the arm of the lever 12 that carries the sprocket wheel 14.

The frame 9 may also support a cable drum 39, as illustrated in Figure 1, but this drum has no operative connection with our torque indicating apparatus.

It is desirable to provide means for regulating the hydraulic pressure in the pipe 29 and connected instruments, so as to increase it when desired. This may be necessary when drilling under conditions where the normal torque in the drill string is relatively higher. For this purpose we provide an open reservoir 40 for the liquid, which may be connected by a pipe 41 to the pipe 29. In the pipe

41 a hand pump 42 is connected for pumping liquid from the reservoir into the pipe 29. A valve 43 in the pipe 41 should be closed after the desired pressure has been developed in the pipe 29.

It is understood that the embodiment of the invention described herein is only one of the many embodiments this invention may take, and we do not wish to be limited in the practice of the invention, nor in the claims, to the particular embodiment set forth.

What we claim is:

1. In apparatus for indicating the torque developed in a drill-string having an endless sprocket chain for driving a rotary table, the combination of a rock-frame with means for supporting the same, a wheel carried by the rock-frame engaging the tight side of the said chain, a hydraulic pressure device connected with the frame, and indicating means connected with the pressure device.

2. In apparatus for indicating the torque developed in a drill-string having an endless sprocket chain for driving a rotary table, the combination of a fixed frame, a rock-frame pivotally mounted on the fixed frame, a wheel carried by the rock-frame engaging the tight side of the chain, a hydraulic pressure device, a tension member connected with the rock-frame and connected with the pressure device for developing pressure in the same to correspond with the force exerted by the sprocket chain on the sprocket wheel, and indicating means connected with the pressure device.

3. In apparatus for indicating the torque developed in a drill-string rotated by a rotary table driven by a sprocket chain, the combination of a fixed frame, a lever pivotally mounted on the fixed frame and having a wheel engaging the tight side of the driving chain, a hydraulic pressure device having a diaphragm and a plunger extending outwardly therefrom, a tension member connected with the said lever and engaging the plunger to maintain the same in a position corresponding to the position of said lever, and recording means connected with the hydraulic pressure device for recording the pressures maintained in the same.

4. In apparatus for indicating the torque developed in a drill-string rotated by a rotary table having an endless sprocket chain for rotating the same, the combination of a fixed frame, a lever pivotally supported on the fixed frame, a wheel on the lever engaging the tight side of the endless chain, a cable anchored at one end and connected at the other end with said lever, a hydraulic pressure device having means for engaging the cable at two points and having a plunger for engaging the side of the cable at an intermediate point between the first named points and operating to hold the cable displaced laterally between said points so that

an increased tension in the cable due to an increased driving force in the chain, develops an increased pressure in the hydraulic pressure device, and means for indicating the pressure existing in the said pressure device.

5. In apparatus for indicating the torque developed in a driving chain for driving a rotary table, the combination of a pivotally supported lever with a wheel carried thereby engaging the tight run of the chain, a taut cable anchored at one end and with its other end attached to the said lever, a hydraulic pressure device having a plunger engaging the side of the cable and maintaining the same displaced from a straight line, and indicating means for indicating the pressure developed in the hydraulic pressure device.

Signed at Los Angeles, California, this 21st day of June, 1929.

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