June 22, 1948. C. L. MOHNKERN 2,443,744

LOCKING MECHANISM FOR WELL DRILLING ROTARIES

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Fig. 1.

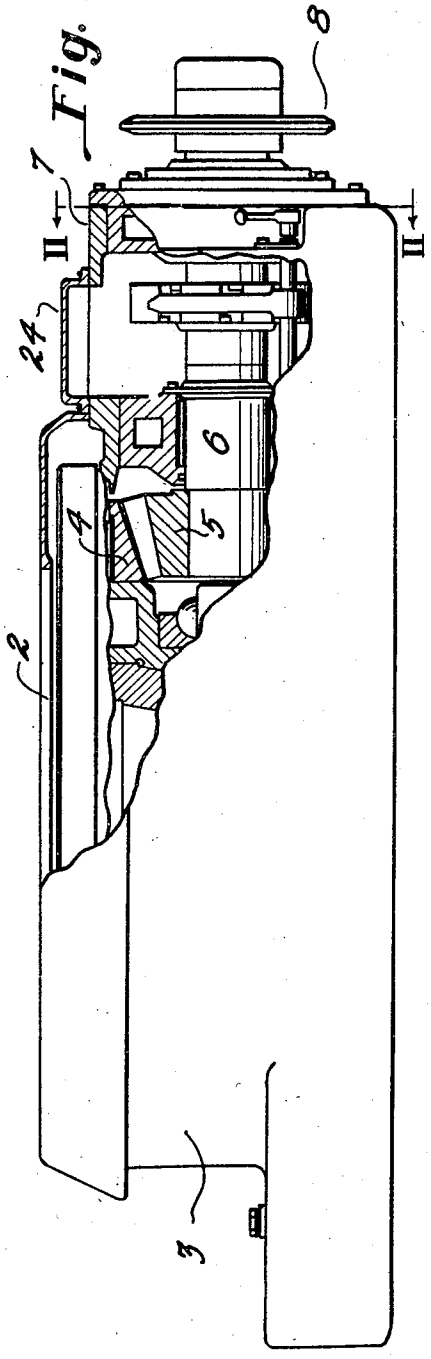


Fig. 3.

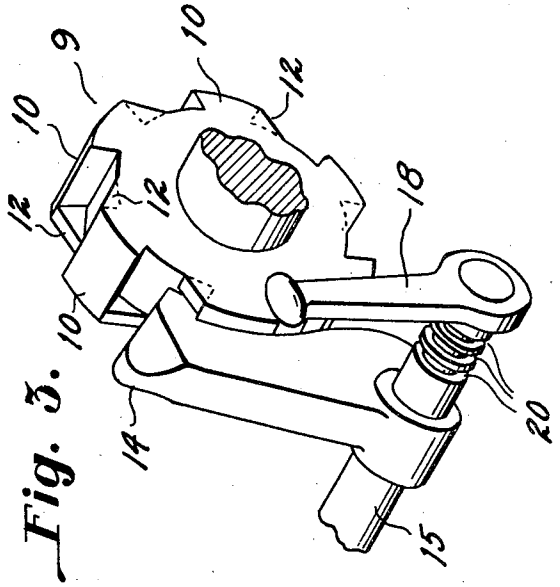
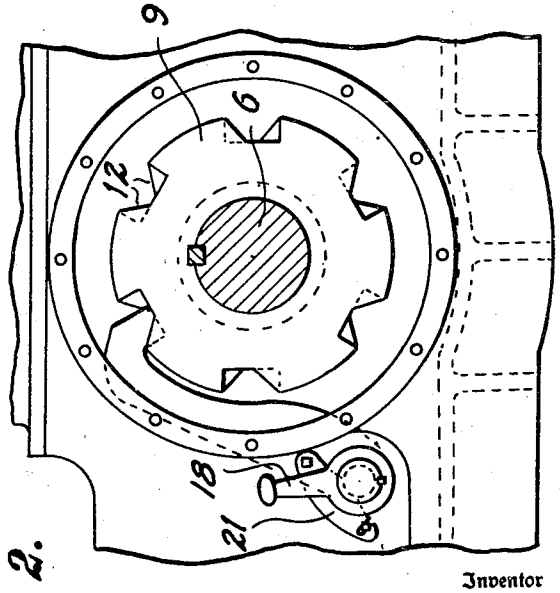


Fig. 2.



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Fig. 5.

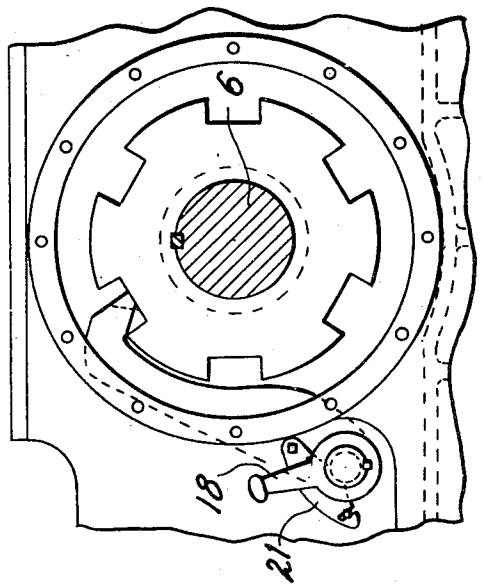


Fig. 6.

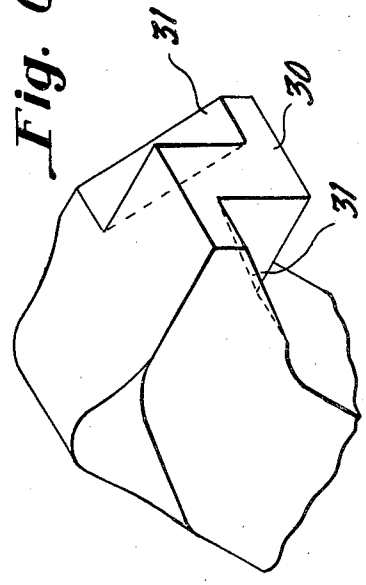
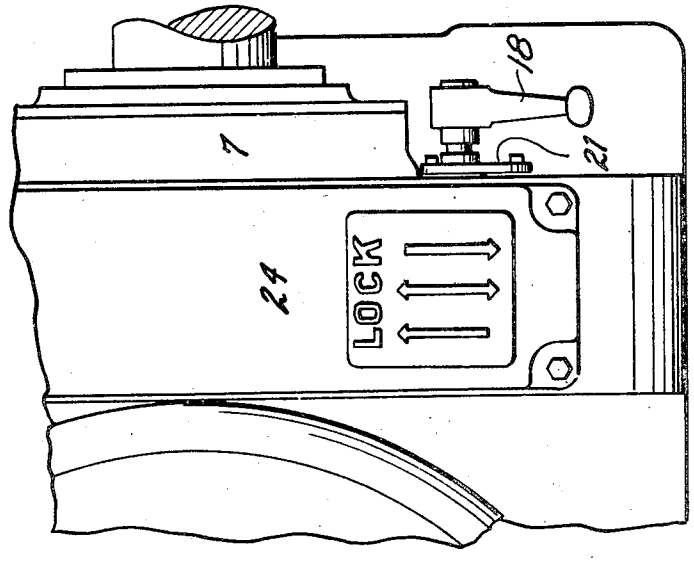


Fig. 4.



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Fig. 7.

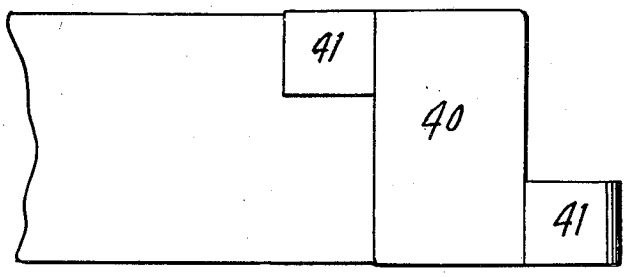
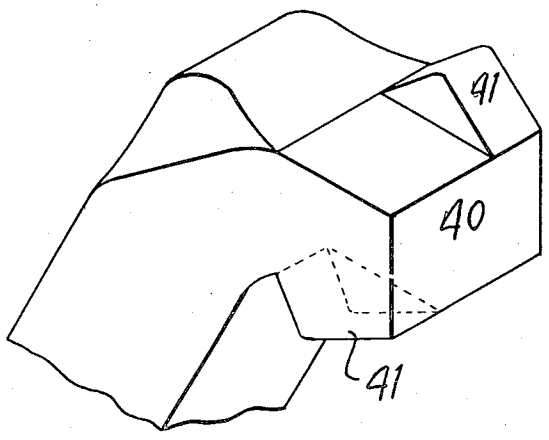


Fig. 8.



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UNITED STATES PATENT OFFICE

2,443,744

LOCKING MECHANISM FOR WELL DRILLING ROTARIES

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Application September 20, 1946, Serial No. 698,219

6 Claims. (Cl. 188—69)

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This invention relates to well drilling rotaries, and more particularly to mechanism adapted to lock the rotary table against rotation as when making up or breaking out the drill pipe joints, etc.

In a rotary machine such as used in the drilling of oil wells by the so-called "rotary method," there is employed a turntable mounted on a suitable bearing and driven through a set of bevel or spiral bevel gears from a pinion shaft, the pinion shaft being either directly connected to a prime mover or driven from the adjacently disposed drawworks by a chain or other driving means. In making up or breaking out the drill pipe joints when going into or coming out of the hole, the drilling string is supported by the rotary turntable in slips and it is necessary to be able to lock the turntable against rotation in either one direction and/or the other.

Various locking devices have heretofore been employed; some locking the turntable skirt, and some locking the gears by means of a dog inserted between the teeth. However, the most popular method at present is to provide a locking wheel on the pinion shaft between the two bearing assemblies and employ a locking dog which can be thrown into engagement with the locking wheel and thus restrain the pinion shaft and the turntable against rotation. Usually where a pinion shaft locking device is employed two locking dogs are required, one to lock the pinion shaft against rotation in one direction and the other to lock it against rotation in the other direction. Wherever it is desired to hold the pinion shaft against rotation in both directions, both locking dogs are engaged with the locking wheel. The principal reason for using two separate dogs instead of one dog which would lock in both directions is that it is desirable under certain operating conditions to be able to ratchet in one direction while holding the pinion shaft against rotation in the other direction.

It is among the objects of the present invention to provide a locking mechanism for well drilling rotaries which employs but a single locking dog and a single locking wheel to accomplish three different locking functions, i. e. the pinion shaft can be locked against rotation in either of two different directions or can be locked against rotation in both directions.

Another object is the attainment of the foregoing while utilizing a single operating lever which may be located conveniently to the operator, thereby greatly simplifying operation of the

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rotary, as well as the construction of the operating instrumentalities.

The invention, then, comprises the features hereinafter described and as particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative of several of a number of ways in which the principles of the invention may be employed.

In said drawings:

Figure 1 is an elevation, partly in section, of a well drilling rotary embodying the invention;

Figure 2 is an enlarged view taken on the line II—II of Figure 1, with the end caps removed to illustrate the general arrangement of the single locking dog and the single locking wheel;

Figure 3 is a perspective of the locking dog and the locking wheel;

Figure 4 is a fragmentary plan taken from above the locking wheel and the locking dog to illustrate the various locking positions of the latter as indicated on the cover for the apparatus;

Figure 5 is a view similar to that of Figure 2, but illustrating a permissive modification;

Figure 6 is an enlarged fragmentary perspective of a portion of the locking dog of the modification of Figure 5; and

Figures 7 and 8 are, respectively, a fragmentary elevation and a fragmentary perspective of a further modification.

Referring more particularly to the drawings, the numeral 2 designates a rotary table rotatably mounted on a base 3 and having a table gear 4 driven by a pinion 5 from pinion shaft 6. A housing 7 encloses the pinion shaft with an end of the latter projecting therefrom for attachment to a suitable source of power, as by means of a sprocket 8.

For the purpose of locking the rotary table 2 against movement in either direction and thereby holding the drill pipe stationary as when breaking out joints, there is provided a locking means in connection with the pinion shaft 6 including a novel type of locking wheel 9 which is secured to the pinion shaft 6 within the housing 7.

Referring particularly to Figures 2 and 3, it will be noted that the novel locking wheel 9 contains a series of jaws or teeth 10 located around its periphery which are adapted to be engaged by the locking dog. Each of the jaws on the locking wheel has a narrow sloping rib 12 at one end which acts as a cam. On one side of each of the jaws 10 the narrow sloping rib 12 is located at

one face and on the other side it is located at the opposite face. As shown at 14, the locking dog which cooperates with the locking wheel 9 is not only narrower than the overall width of the locking wheel, but is in fact sufficiently narrow enough to fit between each of the two narrow sloping ribs 12 on each of the jaws 10.

The locking dog 14 is keyed to an operating rock shaft 15 which can be moved axially in order to change the position of the dog relative to the locking wheel.

When in the central position the locking dog 14 falls between the two sets of narrow sloping cam-like ribs 12 on the locking wheel and locks the wheel in both directions of rotation. This position is shown in Figure 3.

When the operating shaft 15 is moved to the left, the locking dog 14 lines up with the inner row of the narrow sloping cam-like ribs 12. In this position the locking dog 14 holds the pinion shaft 6 against rotation in a clockwise direction but allows it to rotate in a counter-clockwise direction since, as the locking wheel 9 turns in this direction, the cam action of the ribs 12 lifts the locking dog so that it will not engage the jaws 10 on the locking wheel.

When the operating shaft is moved to the right the locking dog lines up with the set of narrow sloping cam-like ribs 12 at the other end of the locking wheel 9 and holds the pinion shaft 6 against counter-clockwise rotation but permits clockwise rotation.

When not in use, the locking dog 14 may be swung out of engagement far enough so that its weight prevents it from accidentally falling into the locking position due to vibration or some other cause.

The operating shaft 15 is supported by the base 3 on each side of the locking dog 14 and the latter is preferably located within the housing 7 where it is protected. Attached to the outer end of the operating shaft 15 where it extends through the housing is an operating hand lever 18 for throwing the locking dog into or out of engagement with the locking wheel and for moving the operating shaft axially to place the locking dog in the desired location. Three grooves 20 are provided in the operating shaft 15 for engagement by a pivoted locking lever 21 in order that the operating shaft may be held in any one of the three desired positions.

As shown in Figure 4, three arrows are placed on the cover 24 of the pinion shaft housing 7, directly over the locking dog 14 and indicate the direction against which the pinion shaft is locked when the locking dog is actuated to each of its three different positions.

Referring to Figure 6, there is disclosed a modified form of the invention which comprises a locking dog 30 provided with a narrow sloping cam-like rib 31 at each of its sides, the same being sloped in opposite directions. This locking dog 30 cooperates with a narrower locking wheel of the usual type, such as that shown in Patent No. 2,306,739, to Maier, dated December 29, 1942. With this modified type of locking dog as used with a conventionally shaped, but narrower, locking wheel, the same advantages are obtained as those described earlier herein.

In Figures 7 and 8 there is illustrated a further modification, the same being adapted for use with the conventionally shaped narrower locking wheel referred to in connection with Figure 6. The locking dog 40 of Figures 7 and 8 is substantially

rectangular and provided with a cam-like rib 41 at each side, one of the said ribs being disposed on the top of the locking dog 40, and the other being disposed on the bottom, as shown. These ribs 41 provide the desired ratcheting effect in one direction by cam action when the locking dog 40 is traversed into the proper position with respect to the conventionally shaped, but narrower, locking wheel; while the central portion of the locking dog 40 provides a positive lock in both directions.

While I have shown and described certain specific embodiments of the present invention, it will be readily understood by those skilled in the art that I do not wish to be limited exactly thereto, since various modifications may be made without departing from the scope of the invention as defined in the appended claims.

I claim:

1. In a rotary having a table and a driving shaft therefor, a housing enclosing the driving shaft, means for locking the rotary table against rotation in either or both directions, including a locking wheel secured to the driving shaft within the housing, said wheel having a plurality of notches therein, a slidable rock shaft extending through the housing, a single dog secured to the rock shaft within the housing, and a lever secured to the rock shaft externally of the housing, said dog being movable with the lever and rock shaft to selectively engage the notches of the wheel, the cooperating contact surfaces of the dog and the notches of the wheel defining a central area within which the wheel is locked against rotation in either direction, and edge areas which respectively prevent rotation of the wheel in one direction while permitting rotation in the opposite direction.

2. In a rotary having a table and a driving shaft therefor, a housing enclosing the driving shaft, means for locking the rotary table against rotation in either or both directions, including a locking wheel secured to the driving shaft within the housing, said wheel having a plurality of notches therein, a slidable rock shaft extending through the housing, a single dog secured to the rock shaft within the housing, and a lever secured to the rock shaft externally of the housing, said dog being movable with the lever and rock shaft to selectively engage the notches of the wheel, the contact surfaces of the notches of the wheel defining a central area within which the dog may lock the wheel against rotation in either direction, and edge areas which respectively prevent rotation of the wheel against the dog in one direction while permitting rotation of the wheel in the opposite direction.

3. In a rotary having a table and a driving shaft therefor, a housing enclosing the driving shaft, means for locking the rotary table against rotation in either or both directions, including a locking wheel secured to the driving shaft within the housing, said wheel having a plurality of notches therein, a slidable rock shaft extending through the housing, a single dog secured to the rock shaft within the housing, and a lever secured to the rock shaft externally of the housing, said dog being movable with the lever and rock shaft to selectively engage the notches of the wheel, the contact surfaces of the dog defining a central area within which the wheel is locked against rotation in either direction, and edge areas which respectively prevent rotation of the wheel in one direction while permitting rotation of the wheel in the opposite direction.

4. In a rotary having a table and a driving shaft therefor, a housing enclosing the driving shaft, means for locking the rotary table against rotation in either or both directions, including a locking wheel secured to the driving shaft within the housing, said wheel having a plurality of notches therein, a slidable rock shaft extending through the housing, a single dog secured to the rock shaft within the housing, a lever secured to the rock shaft externally of the housing, said dog being movable with the lever and rock shaft to selectively engage the notches of the wheel, the cooperating contact surfaces of the dog and the notches of the wheel defining a central area within which the wheel is locked against rotation in either direction and edge areas which respectively prevent rotation of the wheel in one direction while permitting rotation in the opposite direction, means for locking the rock shaft in three separate endwise positions such as will permit the dog and wheel to cooperate within the central area and edge areas aforesaid, and means exteriorly of the housing to indicate the position of the dog relative to the wheel.

5. In a rotary having a table and a driving shaft therefor, a housing enclosing the driving shaft, means for locking the rotary table against rotation in either or both directions, including a locking wheel secured to the driving shaft within the housing, said wheel having a plurality of notches therein, a slidable rock shaft extending through the housing, a single dog secured to the rock shaft within the housing, a lever secured to the rock shaft externally of the housing, said dog being movable with the lever and rock shaft to selectively engage the notches of the wheel, the contact surfaces of the notches of the

wheel defining a central area within which the dog may lock the wheel against rotation in either direction and edge areas which respectively prevent rotation of the wheel against the dog in one direction while permitting rotation of the wheel in the opposite direction, means for locking the rock shaft in three separate endwise positions such as will permit the dog to cooperate with the aforesaid central area and edge areas of the notches of the wheel, and means exteriorly of the housing to indicate the position of the dog relative to the wheel.

6. In a rotary having a table and a driving shaft therefor, a housing enclosing the driving shaft, means for locking the rotary table against rotation in either or both directions, including a locking wheel secured to the driving shaft within the housing, said wheel having a plurality of notches therein, a slidable rock shaft extending through the housing, a single dog secured to the rock shaft within the housing, a lever secured to the rock shaft externally of the housing, said dog being movable with the lever and rock shaft to selectively engage the notches of the wheel, the contact surfaces of the dog defining a central area within which the wheel is locked against rotation in either direction and edge areas which respectively prevent rotation of the wheel in one direction while permitting rotation of the wheel in the opposite direction, means for locking the rock shaft in three separate endwise positions such as will permit the wheel to cooperate with the aforesaid central area and edge areas of the dog, and means exteriorly of the housing to indicate the position of the dog relative to the wheel.

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